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Tool Handling in a Large Manufacturing Plant

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Designing, manufacturing, up-keep and storage of tools are under direction of Maintenance Department—Planning and time study are under direction of Planning Department

KEEPING track of tools and tool steel at the West Allis plant of the Allis-Chalmers Manufacturing Company is something of a problem because of the great variety of jobs undertaken. The plant is really a glorified contract shop, and most of the work goes through in small lots.

Under the ancient system formerly in vogue it was quite possible when a boring mill completed a big job to count seventy or eighty tools of all sorts lying at the machine. Quantities of copper are used in the work, and the most stringent measures were taken to prevent any of it being stolen. Strange to say no one thought of keeping track of three-dollar-a-lb. tool steel, and as a consequence complete new sets of tools had to be issued for standard jobs.

Under the present system all tools are under the control of the maintenance department, which has much wider responsibilities than is usually the case. When a production order is issued on request of the sales department drawings go to the maintenance department to be checked as to method, use of standard tools and existing fixtures, need for making new tools, etc. When new tools or equipment must be made, drawings are made and sent to the superintendent of the department where the job is to be done. If he has any objections as to the tools to be used, their design or the method to be employed, he comes in and argues them out with the maintenance department.

Let us suppose that a given order calls for a part that has been made before. Corresponding to the engineering department drawing number, there is on file a 3x5-in. card, on which the tools available for the job are entered. Another file of somewhat similar cards contains a complete list of tools and fixtures in the plant, each one of which is described on a separate card. On the back of each of these cards is the symbol telling where the tool is to be found. The reason for this will appear later.

When someone gets an idea of a better way to perform an operation a request is made on the maintenance department for the construction of the necessary tools. If the amount of money involved is small a foreman's signature is sufficient authorization when approved by that of the department superintendent. If, on the

Fig. 1—Section of tool dressing department showing bins and rough grinding machines

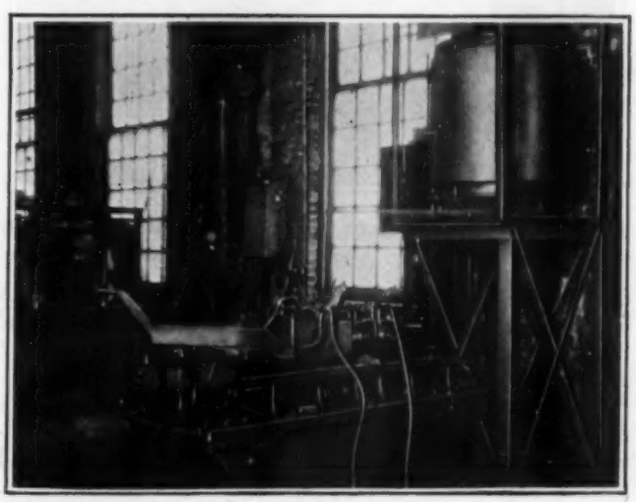

Fig. 2—Where new shanks are welded to high-speed steel tools

Fig. 3—A section of the jig storage room

Fig. 4—A sliding door in the templet rack showing gear templets.

other hand, considerable expense must be incurred the order passes through the hands of the superintendent of maintenance, the general works manager, the president and the comptroller, each of whom must approve it.

A tool appropriation goes with each order of any consequence. The cost section of the maintenance department acts as watch dog on tool expenditures, and calls a halt when the appropriation is about used up. It is occasionally necessary then to apply for an additional appropriation to cover the cost of completing the order.

Tool steel is handled from one small stock room, where the pieces are stored on end, each one being marked over its full length with distinctive stripes to indicate the brand. Metal bandsaws are used for cutting off.

The tool dressing department, Fig. 1, is in another building. Here the various tool crib attendants bring tools that need to be dressed, each lot accompanied by an order. Each tool crib has its own bin for worn tools with another bin into which the dressed tools are put directly below it. Dressed tools are rough ground in this department to prescribed standards and finished ground in the tool crib from which they are issued.

No tipped tools are used in the plant. When a high-speed steel tool has been worn down beyond the useful limit, a 0.40 to 0.60 carbon steel shank is butt-welded to it in a Thomson machine, Fig. 2. The machine is operated by a welder and a helper. The pressure necessary to accomplish the weld is applied to the long lever shown at the left of the machine. When the high-speed part of a tool is all used up, the shank is cut off square and used again, being dressed down to a smaller size if badly battered. The welded tools are heat treated to

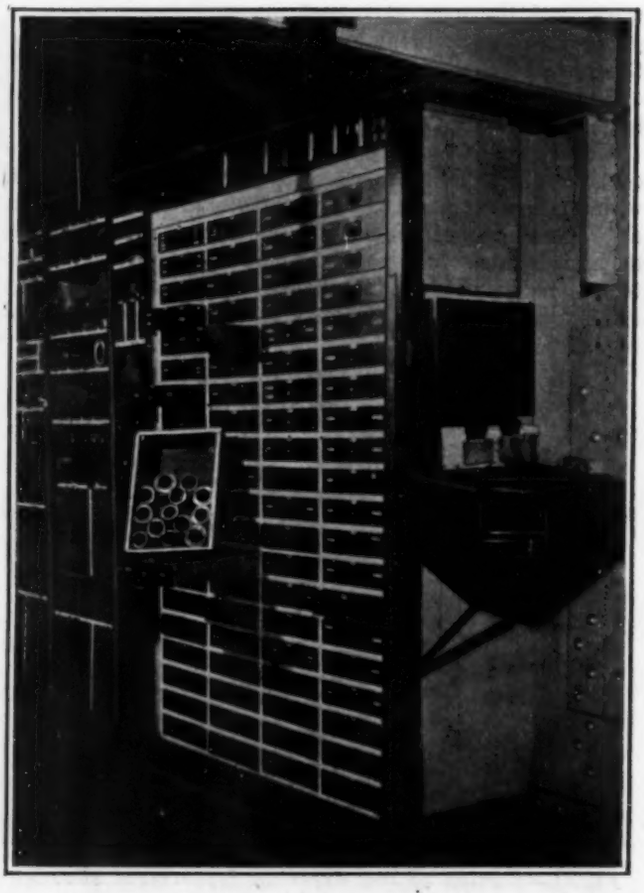

Fig. 5—The drawers where jig bushings are stored

restore the surface altered by the welding heat. The furnace will be seen in the background of the illustration.

Various ways of storing jigs, tools, gages and fixtures are shown in Figs. 3-5. Each item is numbered and its location symbol recorded on the maintenance department file cards, and in the main jig storage files as well. One card is kept in the tool crib where the tool is stored. In the latter department are also stored the road kits, the special road repair tools, portable air compressors, etc. In the case of a new tool or fixture one of the three move orders issued when the tool is authorized comes to the maintenance department, after it has been signed by the man who got the tool. If no report indicating the final disposition of it in the proper tool crib or store room reaches the maintenance department inside of a week, a clerk is sent to find it and to see that it is assigned a place.

Fig. 6—A foreman's desk with battery of push buttons, and the control board

At the same time that the engineering drawing goes to the maintenance department an engineering specification is sent to the time study department. Upon this authorization the time study department decides upon the operations needed and their sequence, and the work tickets, tool orders, etc., are made out on Elliott-Fisher machines by typists. These consist of two white work tickets, one orange tool order, three yellow move orders and one identification tag which goes to the men performing the first operation, and accompanies the work until it reaches its final destination. The same set of slips is made out for each of the operations to be performed on the piece, the final one directing its movement to the inspection department and then to assembly or stock. The control board and the desk of the department foreman are shown in Fig. 6.

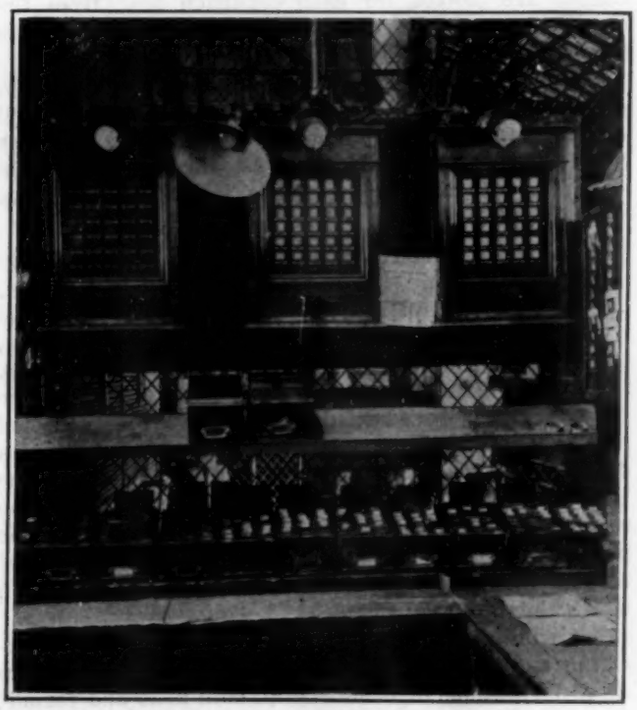

Fig. 7—Annunciator in the tool room to warn toolkeepers of new jobs coming along

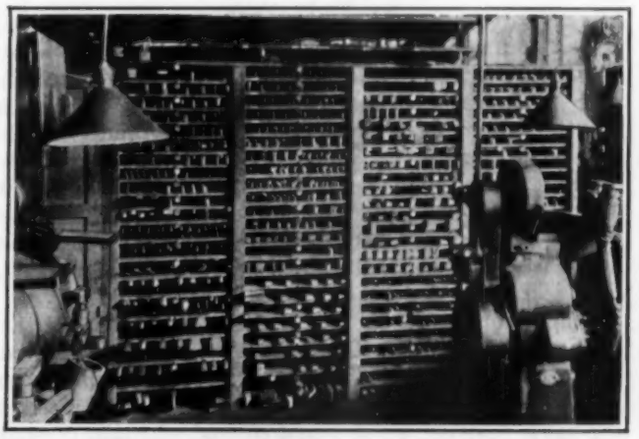

Fig. 8—Tools stored, points out, in a typical tool crib

The tool order is the form that interests us at present. It goes to the tool crib as soon as the foreman assigns the job to a mahcine. The necessary tools for the operation are ascertained from the tool crib file cards, shown in Fig. 7, and are placed in a box ready to be taken to the machine. Then, fifteen minutes before the man at the machine finishes his current job, a button is pressed at the foreman's desk, Fig. 6, which lights one of the signal lamps in the tool crib and calls attention to the fact that one of the arrows on the annunciator board, Fig. 7, is up. Each machine in the department is given a number which also appears on the battery of push buttons at the foreman's desk, and on one of the annunciator boards in the tool crib. The annunciator signal tells the moveman that he must get the tools for the machine in question within ten

minutes. The tools with which the workman is finished are brought back, inspected, sharpened if necessary, and returned to their places.

Some idea of the work involved in getting out the tools for jobs of the type done at this plant may be gathered from the fact that one tool crib alone issued 350 separate tools in a day of 8.6 hours.

Each department has its own tool crib, as stated before. Certain standard tools in frequent use will be found duplicated in the various cribs. Others of a special nature will not be duplicated but will be stored in the department where they are most often used, and will be borrowed by other departments as the need arises; hence the necessity for sympols designating the storage location of each of these special tools and of a record of the symbols in the files of the maintenance department.

The tools in the individual cribs are arranged in a standardized way, with cutting edges outward to facilitate inspection as shown in Fig. 8. They are issued to the machinists on the ordinary brass checks.

"What Is a Used Machine Tool Worth?" —A Discussion

By F. P. Terry

The editorial on page 670, Vol. 61, of the *American Machinist*, introduces a subject of interest to machine shop managers and foremen. It has been a puzzling question to me ever since I became a reader of the *American Machinist*, which was not yesterday, why machine shop owners (it doesn't matter what their nationality) put up so many objections when it comes to the question of modernizing, while on the other hand, we see other industries going to any lengths to save cost upon their products.

One important factor of this direction is the fact that each must keep up with the latest ideas and methods or go out of business altogether, and it would, I am sure, be for the good of all if machine shops stood in the same position, as it would compel adoption of some standard method of depreciation, as suggested by the editor.

Only a few days ago, I was visiting a prominent machine shop, and was invited to see the latest in milling machines. It was a well-known American make of slab milling machine with four cutter heads, and it was "going some"; but what interested me most were the six old plain milling machines near by, creeping along at a snail's pace.

I am sure the whole six of them were not doing more than one-half the work of the latest arrival. I couldn't help remarking that I supposed they were retaining them just as a reminder of the mighty step forward they had taken.

Machine shop owners, the world over, have had knowledge for a good number of years of the almost marvelous results obtained by the specialized plants engaged in mass production methods. Why many of them have not followed up on the same lines, as near the ideal as possible, is difficult to understand, and, although mass production is out of the question with many firms, every one engaged upon manufacturing can move profitably in that direction by getting some sensible system of depreciation going.

Book Reviews

Foreign Commerce and Navigation of the United States—1923. By the U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce. LXVII + 649 pages, 9½ x 12 in. Cloth boards. Sold by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price, $1.75.

The statistics of the foreign commerce and navigation of the United States, published in this issue, correspond to the calendar year ending December 31, 1923. They are the sixth annual report covering a calendar-year period, as previously to June 30, 1918, the reports covered fiscal-year periods instead of calendar-year periods. In order, however, to provide a continuous record, the half-year period from July 1 to December 31, 1918, was shown separately in the report for the calendar-year 1918.

The statistical tables for 1923 of foreign commerce of the United States, which form the main body of the report, are preceded by summary tables of foreign commerce, showing the relation of the calendar year 1923 to previous periods.

A Non-Technical Summary of Research on the Applications of Leather Belting. By R. F. Jones, Research Engineer. Paper covers, 25 pages, 6x9 in., illustrated. Published by the Leather Belting Exchange, Philadelphia, Pa. Designated as R-13. Distributed at no charge to engineers, plant executives, and educational institutions.

An explanation of a series of tests run on leather belt drives under varying conditions, and the results obtained in plotted and tabulated form.

The conditions include arc of contact, center distance, pulley size, pulley ratio, the gravity idler and belt speed as affecting the power transmitting capacity of a belt. Curves are plotted for each condition and, from the results there shown, a leather belting rating chart is compiled.

While there are many variables, such as belt quality, conditions of pulley surface, of heat and cold, of oil and dirt and possible undue belt tension or looseness that will alter calculated figures, the data set down should be of valuable assistance in initial belt drive computation.

The Growth of American Trade Unions, 1880-1923. By Leo Wolman. Cloth board covers, 170 pages, 6x9 in., illustrated. Published by the National Bureau of Economic Research, Inc., New York, N. Y. Designated as No. 6 of a series. Price, $3.

The book is an impartial compilation of facts on the subject named, based on data that have been collected from all possible sources and including, in addition, a detailed analysis of the working population of the United States. It contains valuable information on the subject and is another of the important steps in the program of the Bureau, to provide men of all shades of opinion with objective knowledge of the conditions with which they are confronted.

Distributed throughout the text are numerous interesting and instructive curves plotted from the data to show fluctuations of membership, both male and female. An appendix contains tables carried out in detail on the subject.

A New Process of Hobbing Spur Gears

By Nikola Trbojevich

Principles of the action of constant-pitch conical hobs—Advantages include higher production and smoother tooth surfaces—Method of using the new hobs and some possible applications

THE process of gear hobbing by means of common spur hobs has been so long known and used that its principle of operation has become something like dogma, i.e., the average engineer or gear manufacturer seldom even thinks that this process, simple and admirable as it is, could still further be improved upon and rendered more effective for practical purposes.

However, the writer has perfected and patented a modification of that process that promises to be of a revolutionary character. The main advantages claimed

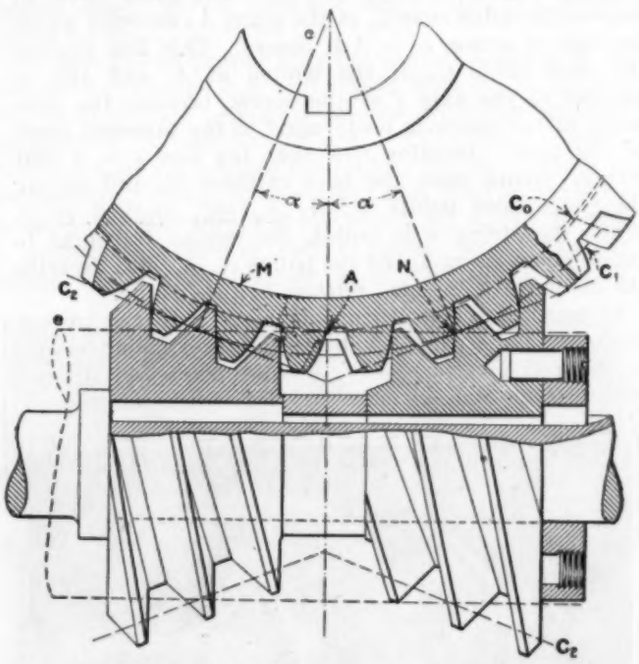

Fig. 1—According to the new principle, spur gears are hobbed in common hobbing machines by using two cone hobs, both right handed. Note that in this arrangement the line of action "e" is parallel to the hob axis, resulting in generation of correct involutes

for this improvement are: (a) Increased production of the common hobbing machines both for roughing and finishing; (b) smoother finish of gear teeth; (c) better cutting action which resembles shaping rather than milling; (d) generation of a more nearly true involute; (e) less springing in the hob and gear arbors due to the practical absence of a separating force during the finish cut; (f) use of the same pair of hobs either for roughing or for finishing; (g) the thickness of teeth on the pitch line is not effected by slightly changing the depth of cut; (h) less power is required for each cubic inch of metal removed.

The principle of operation of the new hobs will best be understood from the diagrams in Figs. 1 and 2 and the accompanying photographs. The hobs used are conical hobs of constant pitch, the tooth curves of which are Archimedean spiral segments in plane development. These hobs should not be confounded with the commonly known tapered hobs which are used for tangential hobbing of worm gears, for instance, because the latter hobs are merely a mutilated form of the common spur hob and their teeth are relieved in planes perpendicular to the axis of the cutter; whereas in the new hobs the teeth are relieved in planes perpendicular to the sides of the cone, and the rack element is inclined relative to the axis at an angle equal to the cone angle of the cutter. The new hobs are, therefore, the same hobs which the writer first used in connection with this method of hobbing spiral bevel and hyperboloidal gears, as described in Vol. 59, No. 18, of the *American Machinist.**

As shown in Fig. 1 two conical hobs having the same hand of thread are mounted on the hob arbor of a common hobbing machine with their smaller ends adjacent, and are separated from each other by a spacing collar, of a width depending on the number of teeth in the gear which it is desired to generate. The hobs

Fig. 2—A diagrammatic plane development of the pitch circle of the gear shown in Fig. 1, indicating that the hob teeth engage the gear teeth with a line contact

are gashed so that they cut in the same direction, i.e., one is a "right cut" and the other a "left cut" hob as looked upon from their respective large ends. The cone angle of the hobs is usually selected one degree less than the pressure angle of the gear, 19 deg. for a pressure angle of 20 deg. and 13½ deg. for 14½-deg. pressure angle. The reason for this will be explained

*Complete control of the process of hobbing spiral bevel and hyperboloidal gears including patents has been disposed of to the Gleason Works. An exclusive license for United States and Canada of the process of hobbing spur, helical, double helical and worm gears, spline shafts, sprockets and the like was disposed of to the Union Twist Drill Co. who are now preparing to place these hobs on the market. The foreign rights for the last named process only (spur gears, etc.), are still controlled by the writer of this article.

later on. The pitch or lead of the hobs (always measused along the side and not the axis of the cone) is calculated in the same way as for the common spur hobs, i.e., the normal or base circle pitch must be the same both in the gear and the hob.

The thickness of the hob teeth on the pitch line is less than the width of the interdental spaces of the gear teeth, and the hobs are so adjusted that only the sides of the conical thread lying nearest to the cone apex generate the finished tooth curves. Thus, each hob operates only on one side of the teeth while the bottoms of the tooth spaces are produced by an overlapping cut of both hobs.

Suppose now that the hobs shown in Fig. 1 are rotated in unison with the gear blank. In that case the rack elements C_2 of the hobs will appear to move

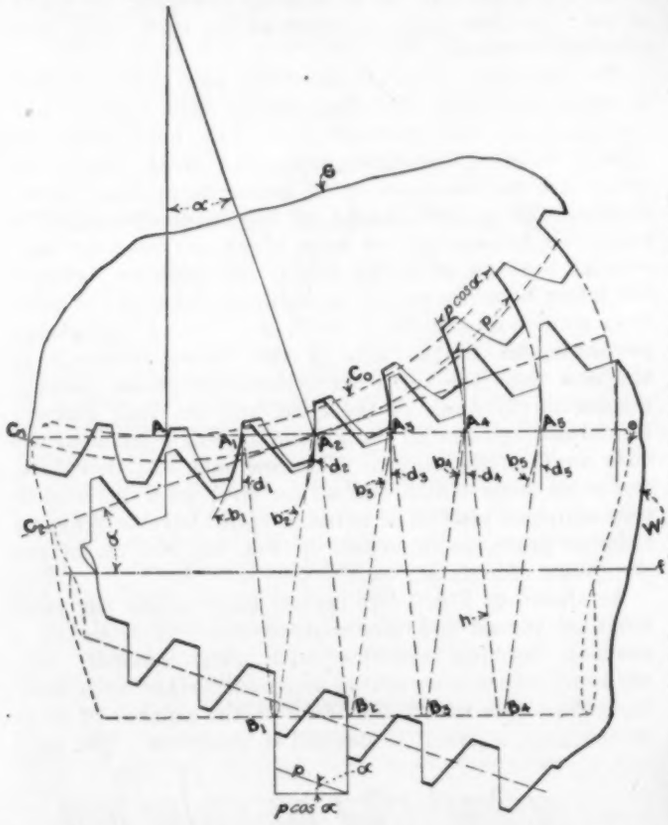

Fig. 3—Generating an involute spur gear lamina with a conical screw of a constant pitch. The involutes "b" and the helix "h" are conjugate to each other

with the same velocity as, and tangentially with respect to, the pitch circle C_1 of the gear, the corresponding points of tangency being at M and N. It is readily seen that this engagement is continuous and it also takes place at a constant ratio, because the lead of the hobs along the pitch lines C_2 is constant and corresponds to the pitch of the gear blank. The line of action is the generator of the cylinder e, this cylinder being concentric with the hob axis, and touches the base circle C_0 of the gear at the point A.

In Fig. 2 is shown diagrammatically the character of the line contact existing between the paths of the cutting edges of the hobs and the gear teeth, the main advantage of this new method of gear hobbing.

The substance of the writer's new theory in which the well-known involute helicoids are considered as the

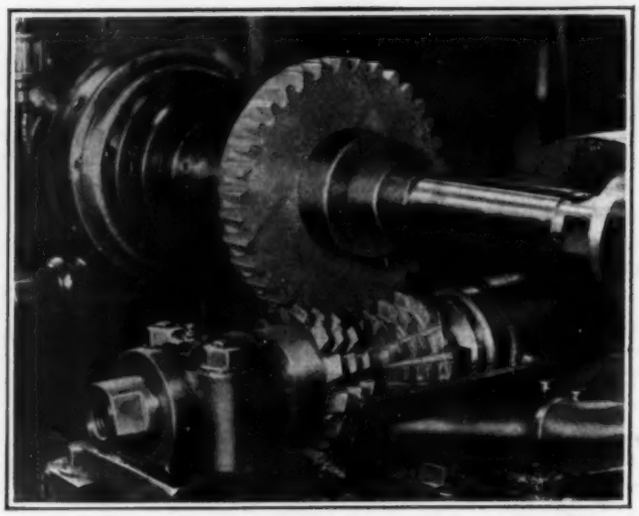

Fig. 4—Roughing out a 5-7 pitch gear, 34 teeth, with a feed of 0.220 in. per rev. of blank in a commercial hobbing machine

geometrical envelopes of conical screws, will be understood from Fig. 3. Let G be an involute gear lamina of infinitesimal thickness, and W the cross-section of a conical screw meshing with it. The pitch circle C_1 touches the pitch cone C_2 at the point A_3, through which the line of action $e = AA_3$ passes. This line touches the base circle C_0 of the lamina at A, and also is parallel to the axis f of the screw, because the cone angle of the screw is made equal to the pressure angle of the gear. Imagine now that the line e is a taut string, wound upon the base cylinder C_0 and having the equi-spaced points A_1, A_2, A_3, etc., marked on it. When the string e is pulled, the lamina G begins to rotate about its axis, and the points A_1, A_2, etc., describe the involutes b_1, b_2, etc., relative to the lamina.

If now the screw W runs in mesh with the lamina, evidently the string e will describe a cylinder relative to the axis f of the screw, and the points A_1, A_2, etc., will describe one or more circular helices h upon the

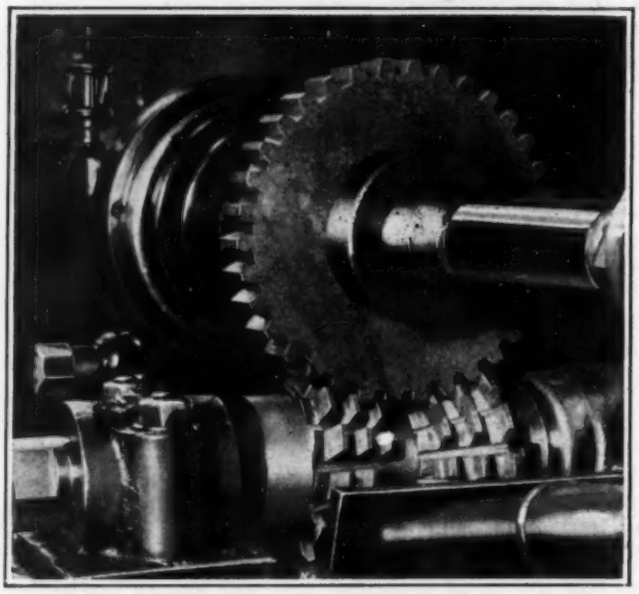

Fig. 5—Adjusting the hobs preparatory to finish cutting the gear shown in Fig. 4. The same hobs may be used both for roughing and finishing

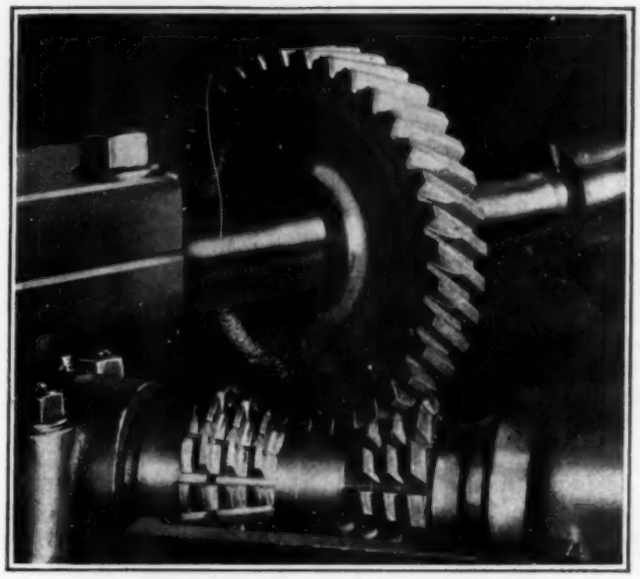

Fig. 6—Finish hobbing a helical gear 7-9 pitch. Note the line contact

cylinder. Thus, an involute lying in the plane of the lamina G and a helix drawn about the axis f are conjugate odontic curves when they are rotated in a proper timed relation.

It can also be proved that the conical helicoid W of which the parallel and equi-spaced lines d_1, d_2, d_3, are the axial section, correctly meshes with the involute helicoids b_1, b_2, etc., of the gear. (The term involute helicoid means a helicoid the leading curve of which is an involute.) First, it is evident that the two surfaces touch each other always at the points A_1, A_2, A_3; second, a system of planes drawn at these points tangent either to the conical screw W or the helical gear G are all parallel and therefore coincide, providing the sum total of the helical angles of the screw and the lamina G is equal to a right angle.

That the tangent planes erected at A_1, A_2, etc., upon the conical screw W are all parallel is evident, because each tangent plane, for instance the one at the point A_3, must contain the line d_3 and also the tangent to the circular helix h at that point. Therefore, the lines d_1, d_2, d_3, being all parallel, and the tangents to the helix h also being parallel to each other in any axial section, the whole system of planes is also parallel.

The planes tangent to the gear G at those points are also parallel to each other, which fact can be proved although the full proof involves higher mathematical calculations. Briefly, an involute helicoid is the envelope of a plane when the plane moves along a helix concentric with the axis of the helicoid, always maintaining an "osculating" position relative to the helix. Therefore, all tangent planes to an involute helical gear intersect the axis of the gear at a constant

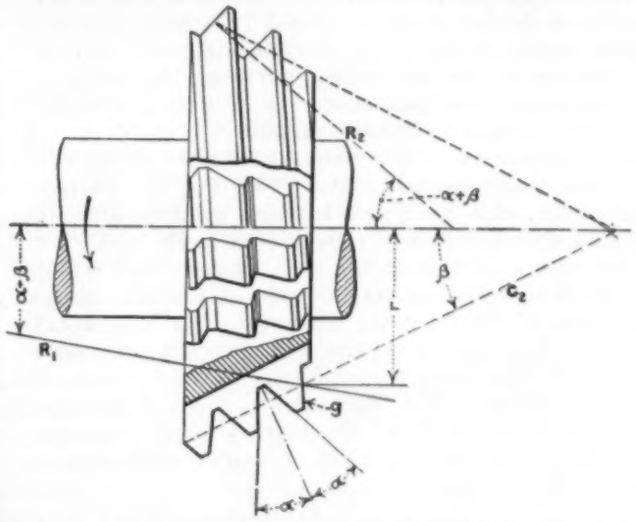

Fig. 7—In the new cone hobs the radius of curvature R_1 of the side of thread which does the generating is over seven feet long for a hob of three inches in diameter

angle. If we now select a system of tangent planes erected to the gear at the points A_1, A_2, etc., those planes are all parallel to each other, no matter what the helical angle of the lamina G is, because they intersect the axis of the lamina at a constant angle, and because their traces d_1, d_2, d_3, in the plane of drawing are all parallel.

It was found that the above statement is generally true also for the condition when the axis of the worm G is not perpendicular to the axis of the gear as shown in Fig. 3, and that a conical worm of a certain pitch and pressure angle may be brought into a correct engagement with any spur or helical gear of a similar pitch and pressure angle and generate the same.

Thus we arrive at the surprising conclusion that the conical hobs are more nearly theoretically correct than the spur hobs. Because in spur hobs the line of action (the locus of points of the hob that do the actual generating) is a *conical helix* having a different angle of inclination at every point, whereas in the new hobs the line of action is for all practical purposes a *circular helix*, having a constant angle of inclination. Therefore, when a spur hob is rotated it will appear that the tangent planes along the line of action oscillate, that

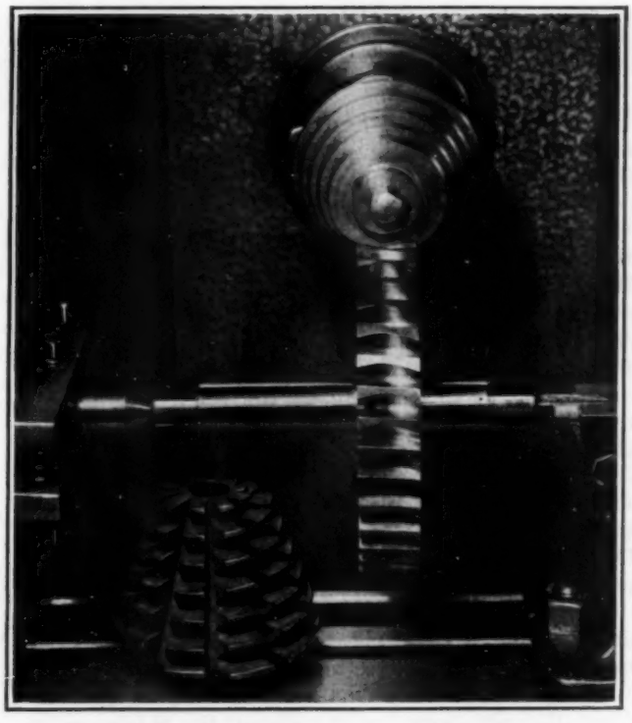

Fig. 8—A new worm gear meshing with a conical screw. The hob that did the job is seen at the lower left side of the picture

is, change their angle of inclination from one end of the line of action to the other, and cause what is sometimes termed "helical interference," while in the new hobs the tangent planes do not oscillate. This fact the writer has also succeeded in proving experimentally by generating with the new hobs in a gear a true involute within 0.0002 in. on one side of the tooth, and within 0.0008 in. on the other side.

The most important advantage of the new hobs is that the path of the cutting edges remains for a greater length of time in the immediate proximity of the tangent or the rack plane. For this reason the gears are finished with a peculiarly smooth finish not at all resembling the commonly known "hobbed finish" at any point except in the bottoms of the teeth. The crosswise serrations or feed marks, so characteristic of the common hobbed finish, are here entirely lacking.

This peculiarity will be noticed by carefully examining the photographs shown in Figs. 4 and 6 in which one fully, and two partly finished gears are shown. It can be proved by calculation that the new hobs are capable of taking a chip fully one inch long, and still remain within 0.001 in. of the finished tooth surface. In other words, for all practical purposes, the new hobs are comparable to a gear shaper reciprocating at a rate of several thousand strokes a minute.

The explanation of this unusual behavior of the new hobs will easily be understood from Fig. 7. In that figure a conical hob is shown having a pressure angle of the rack element equal to α and a cone angle equal to β. In our case $\alpha = 20$ deg. and $\beta = 19$ deg., from which it follows that the generating side of the hob thread (the side of thread lying nearest to the cone apex) is a very flat, slightly convex cone having a cone angle relative to the planes perpendicular to the hob axis of only one degree. The "back-cone radius" of this flat cone for a hob of 3 in. diameter is 86 in., whereas the same radius for a spur hob of similar dimensions is only $4\frac{3}{8}$ in. Because, from Fig. 7

$$R_1 = \frac{r}{\sin(\alpha - \beta)} \qquad (1)$$

where r is the pitch radius of the hob, and R_1 the back-cone radius (or the radius of curvature) pertaining to the side of the thread lying nearest to the cone apex. It is evident that the formula (1) is true for all values of α and β. Thus, in order to obtain the backbone radius of a common spur hob, $\beta = 0$ is substituted in the equation (1). When this is done, the above-mentioned values for those radii will be obtained showing that the radius of curvature of the new hob thread is approximately 20 times greater than in the case of common hobs. In other words, *the new hob having a mean pitch diameter of only three inches, approximates the tooth surfaces as closely as would a common hob of five feet in diameter.*

That condition is clearly shown in Fig. 8. The worm gear illustrated was cut by sinking the cone hob into the blank without any sidewise or crosswise feed. As it is seen, the sides of the teeth which were generated by the side of the hob thread lying nearest to the cone apex are almost perfectly straight while the sides generated by the other side of the hob thread are sharply concave and resemble the teeth of a common worm gear. This feature indicates that with the new hobs it is possible to take enormous feeds, and, were it not for the hollow curve in the bottoms of teeth, feeds as high as one inch for each revolution of the blank could be employed.

The gear shown in Fig. 5 was cut with a feed of 0.220 in. per revolution and showed a rather smooth finish. It is believed that with a sufficiently rigid hobbing machine feeds as high as from one-half to three-quarters of an inch could be employed in practice, and gears of a good quality obtained. Anyone who is familiar with gear manufacture will appreciate what these figures mean. It is further believed that it will be found practicable by using specially designed hobs to rough out and finish gear blanks in one single cut. The peculiarity of the process according to which the finished tooth curve is generated first on one side and then on the other, through a comparatively long arc of contact, renders this idea, in the writer's judgment, entirely feasible.

How the New Hobs Are Used

As indicated in Fig. 7 and the equation (1), if the cone angle of the new hobs were increased to equal the pressure angle of the rack element, the radius of curvature of the hob thread would become infinite. However, in that case certain interferences between the hob thread and the imaginary rack plane would creep up and the gear teeth would be slightly mutilated. It can be proved by calculation that those interferences disappear in an ordinary cone hob when the cone angle is reduced by 0 deg. 38 min. The writer has increased that allowance to one full degree, in order to be on the safe side. As already stated, actual experiments and measurements have verified this theory.

Hobbing of spur or helical gears by means of the new double-cone hobs is not materially different from the commonly known operation of that kind. The two hobs and the spacer between them are placed on the hob arbor of a common hobbing machine, and are tightened up in the usual way. As the hob helixes must be correctly aligned in order to produce the desired thickness of tooth, and as the spacer was selected by taking this factor into consideration, it is desirable that the hob arbor be provided with a perfectly straight and ground key. The hobs are then centered relative to the blank so that both hobs touch the outside diameter of the blank. No great harm will result if the hobs were not accurately centered, because the thickness of teeth and the pressure angle of the involutes will come out correctly in any case, only there will be a ridge in the bottoms of the teeth if the hobs were not correctly centered.

The hob arbor is then tipped to an angle corresponding to the thread angle of the hobs. When helical gears are hobbed, the hob arbor is tipped in the usual way, the only difference being that the angle of the gear helix is not measured in this system on the pitch line of the gear, but on its base line or base circle. However, the calculation of the change gears (feed gears and index gears) is not altered thereby, and the same gear ratios which are now employed, may also be employed in this method.

The depth of the cut is then adjusted, and the gear is ready to be hobbed. As already stated, the depth of the cut may be changed within comparatively wide limits without affecting the thickness of the teeth, because the generating edges are inclined relative to the hob axis to only a very small angle.

When the new hobs are sharpened, the thickness of the generated teeth will slightly change. Thus, for a customary side clearance of the hob teeth equal to 3 deg., when the fronts of the teeth are ground off to

a distance equal to 0.010 in., the hobs will generate teeth 0.001 in. thicker than they did previous to sharpening. An allowance for this increase is made either by changing the width of the spacer, or by tipping the hobs to a slightly different angle.

The manufacture of the new hobs is not substantially different from that of the common hobs. The finishing hobs should be ground in the thread after hardening, similar to common hobs, with the important difference, however, that the *teeth need to be ground on one side only*, the side lying nearest to the cone apex.

Large as well as small gears may be produced. When pinions are generated the spacer between the two hobs may be omitted, the hobs touching each other with their smaller ends. It may be seen from Fig. 1 that no matter how few teeth the pinion has, the line of action *e* for each tooth curve never extends beyond the point *A* lying in the central section of the blank; therefore, all involutes will be fully generated, providing the hobs are made sufficiently long to include the point *A*.

When the gears are too large it may happen that the two hobs would have to be placed so far apart from each other that the hob arbor having an ordinary length only would not be sufficiently long to hold the hobs; in that case the hobs may be made with less cone angle than the customary 19 or 13½ deg., which modification will, evidently, bring the hobs as near to each other as may be desired under the conditions. This will involve a certain sacrifice in the length of chips produced by the finishing hobs, but the cutting action will still remain superior to that of the common hobs.

It is believed that the new hobs will prove successful in the generation of helical gears, especially of timing gears for automobiles, because of the extremely smooth finish, combined with the theoretical accuracy, obtainable by this method. It may be also found practicable to generate herringbone gears by the Wuest method by using multiple-threaded and spirally-fluted hobs of this kind. The advantage would be that the helix angle of the hobs may be kept constant after repeated sharpenings by simply adjusting the hobs for a corresponding amount toward the center-line of the blank.

An interesting development in worm gearing is indicated in Fig. 8 which shows a gear driven by a tapered worm, That construction may be rendered still more effective by using two worms as shown in Fig. 1. It is believed that a worm drive of this kind would make an ideal gear to be employed in hobbing machines, milling machines and other machine tools, because the back-lash is readily adjusted without changing the center distance, and the center distance itself does not need to be very exact. An interesting peculiarity of the gear drive as suggested in Fig. 1 is that in spite of the conical form of the worms, the rubbing velocity is not greater on the large ends than on the small ends, because the plane of action is parallel to the worm axis.

Toothed elements other than gears, such as spline shafts, sprocket wheels, etc., may also be produced with the conical hobs.

The Law on Employment of a Minor

By Leslie Childs

THE wide enactment of factory acts, which limit the age under which minors may not be employed in given industries, casts certain burdens upon the employers. The question, of the effect on the liability of an employer of a minor's misrepresentation relative to his age, has been the cause of considerable litigation.

In other words, if a minor below the age limit is employed by virtue of misrepresentation as to his age and thereafter suffers injury, may the employer defend his unlawful employment on the grounds of the latter's misrepresentations? It is, of course, obvious that each case of this kind must be decided in the light of the particular facts involved, but, even so, a brief review of some of the decided cases on the question may prove of interest and profit. With this in mind American Car & Foundry Company vs. Armentraut, 214 Ill. 509, is worthy of attention.

In this case the plaintiff was a boy twelve years of age when employed in the defendant's factory. The law required that such employee be at least fourteen years of age. The plaintiff suffered an injury and sought damages when the question of his unlawful employment was brought in issue.

The defendant, employer, contended that if the plaintiff in seeking the employment knew he was under the age required by the law, and falsely stated that he was over that age when employed, he could not recover because his own misrepresentation concurred in causing the injury. In denying this contention the court said:

"This doctrine is not applicable for the reason that the statute under consideration is aimed at the master, and not at the servant. The act of the child in accepting or entering into the employment is not unlawful. Moreover, if the child's statement to the effect that he was above the age of sixteen would constitute a defense, the law could never be enforced in any case where the child was willing to make a false statement in reference to his age for the purpose of obtaining the employment."

Let us examine a case in which the question of how false statements on the part of such a child's parents would affect the right to recover, when made to secure employment forbidden by law. For this purpose the Indiana case of the Inland Steel Company vs. Yedinak, 172 Ind. 423, will serve.

In this case the statute required employees to be fourteen years of age. A boy who was employed and injured in the service brought an action to recover. There was evidence to the effect that the boy was not fourteen years of age and was therefore unlawfully employed. In reply to this the employer claimed that the boy had misrepresented his age, and further that his mother had furnished an affidavit showing his age to be above that required by law. In outlining the evidence on this point the court said:

"Appellant's, the employer, counsel contends that if appellee was under age he procured the unlawful employment by falsely representing his age to be over fourteen years, and therefore he cannot avail himself of exemption from responsibility for contributory negligence, and profit by his own wrong.

"Appellant's timekeeper testified that when appellee applied for work he said that he was over fourteen and under sixteen years of age, and thereupon was fur-

nished a suitable blank to be filled out so as to show his exact age, and be sworn to by his mother; that appellee returned this paper, subscribed and sworn to by his mother, . . . and he was then set to work.

"Appellee denied making any statement concerning his age, but testified that the superintendent or timekeeper furnished him a blank affidavit to be made by his mother, which he returned, but that he did not read it and had no knowledge of its contents."

In passing upon the weight of the above conflicting evidence, in so far as it might relieve the defendant employer from the liabilities imposed by the statute, the court said:

"If appellee was, in fact, under fourteen years of age when he was employed, . . . then it is immaterial which of these conflicting statements is true. Appellant was positively forbidden to employ him until he was fourteen years of age, and was bound, at its peril, to know that, while in its service, he was not within the inhibited age."

The foregoing cases represent one line of holdings on the question under discussion, and from them it is obvious that where they are followed the employer is bound, at his peril, in employing a minor below the age limit set by law.

More Liberal Opinions

Another line of cases seem to be somewhat more liberal in the matter of allowing the employer to justify his employment of a minor below the age limit, where such employment is given after the exercise of due caution by the employer.

In Koester vs. Rochester Candy Works, decided by the New York Court of Appeals, 194 N.Y. 92, the court in passing upon this question said:

"The gist of civil liability is the negligence of the master in employing a person of such tender years that the legislature has forbidden his employment. Therefore, if the employer, in the exercise of proper vigilance and due caution, is led to believe that the employee is above the statutory age, he cannot well be charged with negligence in employing an infant, whether such belief would be available in a criminal prosecution or not. . . .

"The question always is whether the employer is justified in believing that the employee is of sufficient age to authorize his employment. For this purpose he may not rest alone on the representation of the plaintiff, but is required to exercise proper vigilance to discover the fact. What such vigilance would dictate differs in different cases. . . .

"No definite rule can be laid down to relieve the employer from liability in violating the statute. The jury must be satisfied that under the circumstances of the particular case the employer believed, and was justified in the belief, that the employee was of the prescribed age for work."

Responsibility Lies With the Employer

The foregoing decisions constitute a valuable cross-section of the law on the subject under discussion. In the light of these holdings it is obvious that the violation of a statute, aimed at the protection of minors in their employment by an employer, places the latter in a difficult position to defend.

Under the holdings of the first line of cases, the fact that the employer employed the minor because of the latter's false representations as to his age does not constitute a defense for the unlawful employment. Under the second holdings, which appear somewhat more liberal, the best the employer can do is to show that his acts in employing the minor were justified by his belief that the minor was of proper age.

With the law in mind, as announced in the foregoing cases, it is obvious that great care should be exercised in the employment of minors below the age specified by the statute. Certainly in such situations the employer will not, as a general rule, be justified in relying solely on the representations of the applicant. The burden of going beyond this and ascertaining the fact is placed squarely upon him, and he acts at his peril.

American Machinists for French Schools

Editor, The *American Machinist:*

Sir: It has been my good fortune during my year's leave of absence from the University of Chicago to be able to visit many of the technical schools in France including practically all of them at Paris. These schools have found the economic situation resulting from the war a heavy burden for them, for their resources have not increased in anything like the same ratio as their essential expenditures. One result has been to cut them off from the possibility of subscribing to American technical and scientific magazines, for, in addition to limited resources, the rate of exchange is heavily against them. The subscription to a $5-a-year American magazine delivered in France, costs them, for example, the equivalent of a week's wages for a first-class machinist.

I wonder if there are not some subscribers to your magazine who do not permanently file or clip their copies who would be willing to send them regularly to some French technical school which would appreciate greatly this addition to their teaching material. If there are any such, and they would send their names and addresses to me, 52, Bd. Pasteur, Paris (XV), France; after Sept. 1, 1925, 5529 University Ave. (Chicago, Ill.), or to Monsieur Firmin Roz (96, Bd. Raspail, Paris (VI), France), Directeur de l'Office National des Universités et Ecoles Françaises, we should be glad to give to each the name and address of a school to which to send his copy. Monsieur Roz has gladly consented to handle this matter permanently at this end, and as he has a thorough command of English, subscribers will have no difficulty in corresponding with him. They may rest assured that when I leave France, any information which they may desire can easily be obtained from a competent source.

I can assure the readers of this letter that in sending their copies of this magazine to a French school, they will be aiding French technical education more than they realize and they will be helping France in a fashion which will be most gratefully appreciated by all Frenchmen who know of it as well as by those who benefit directly by it. PAUL M. ATKINS.

[Professor Atkins' suggestion has our hearty support. It offers an opportunity for those interested in French efforts to "come back" to do a little bit to help. We urge such subscribers to communicate with Professor Atkins or Monsieur Roz. For our part, as soon as any one has secured the name and address of the school or individual to which his copies are to go, we will be glad to supply him with addressed wrappers so that the mailing will be simplified as much as possible. —*Editor.*]

AUTOMOTIVE PRODUCTION

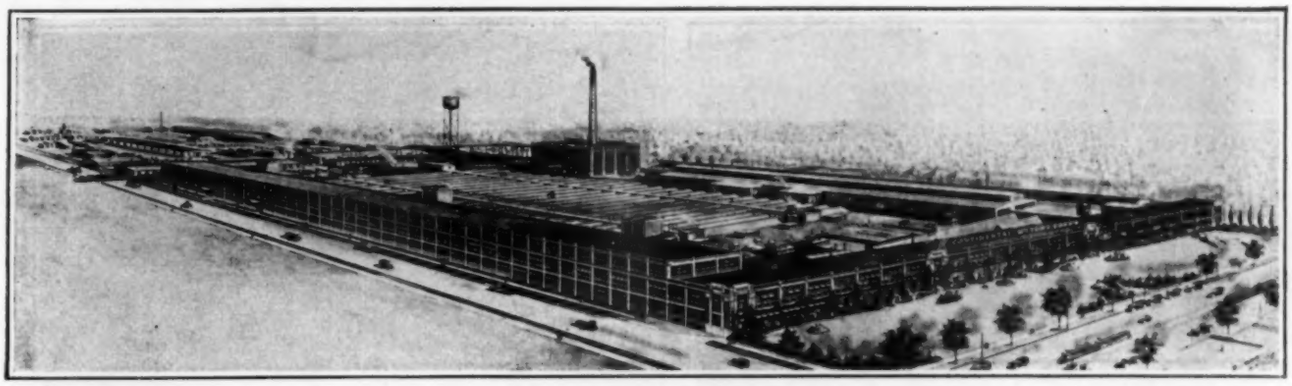

Fig. 1—The Detroit plant

Policies and Methods Underlying the Manufacture of Red Seal Continental Motors

By John Younger
Associate Editor, *American Machinist*

A Story Largely in Pictures

THE Continental Motors Corporation of Detroit and Muskegon has been a specialist in gasoline engine design and construction for twenty-four years. A view of the Detroit plant can be seen in Fig. 1. During this period it has tried out many experimental ideas; has discarded some and adopted others and has gained a steadily growing appreciation of the value of conservatism in both design and construction. Its engines are designed to do their work faithfully with no special fuss or frills, and similarly their construction follows the same policy. A high quality of workmanship combined with low cost of manufacture is aimed at, and in the shops one sees machines of the latest type alongside some of an older design, but all very obviously working out the one policy. There are no freaks among these tools, and the general

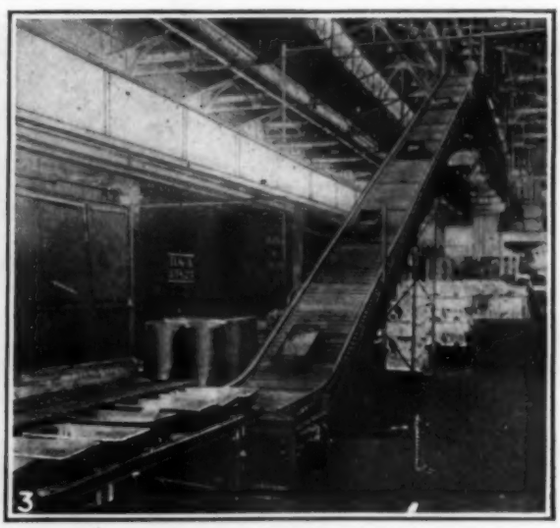

Fig. 2—Johannson gages are used freely for checking purposes. Fig. 3—Conveyor feeding the stock rooms from the receiving platform

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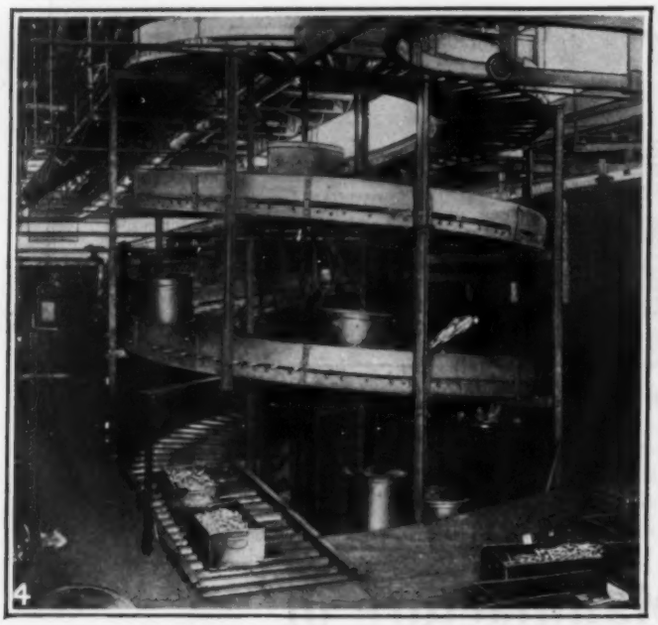

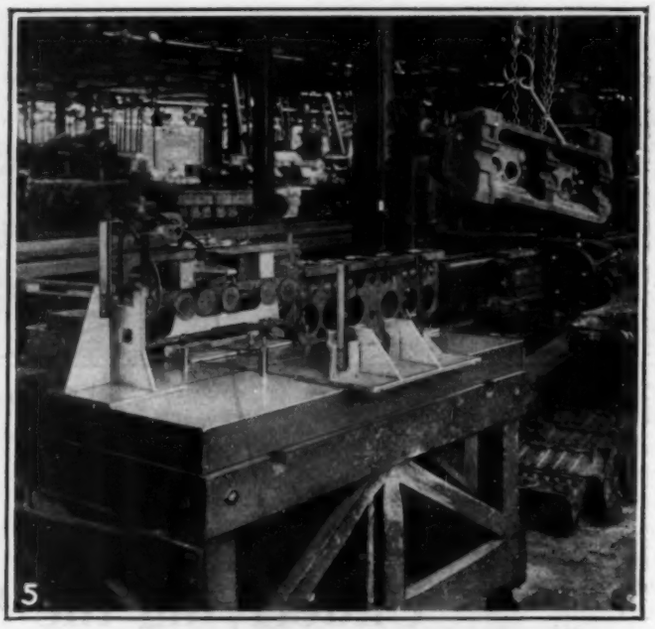

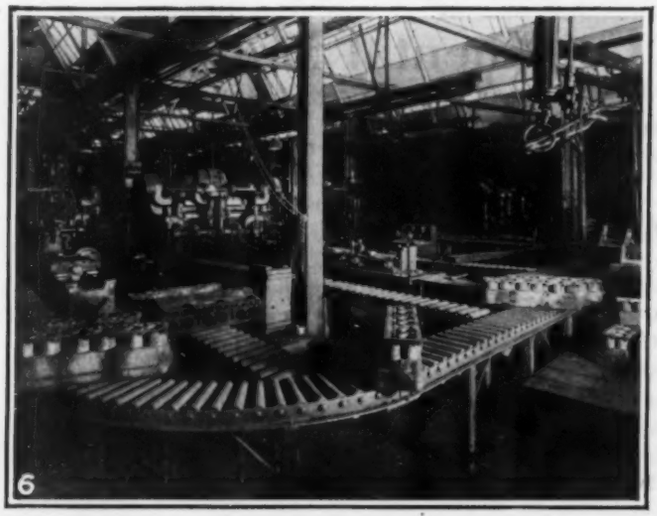

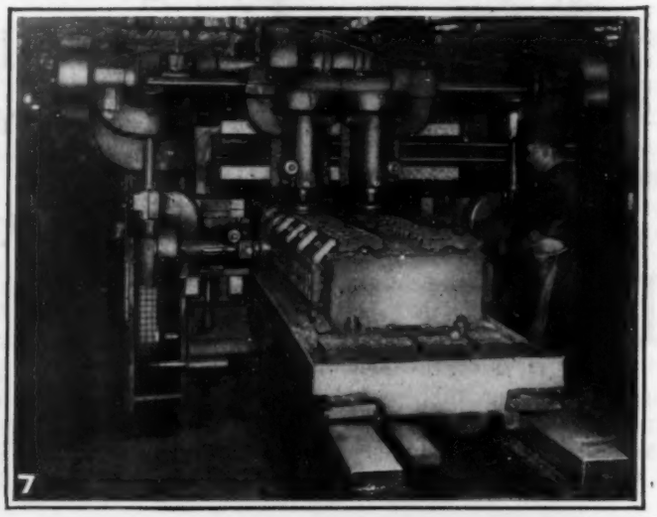

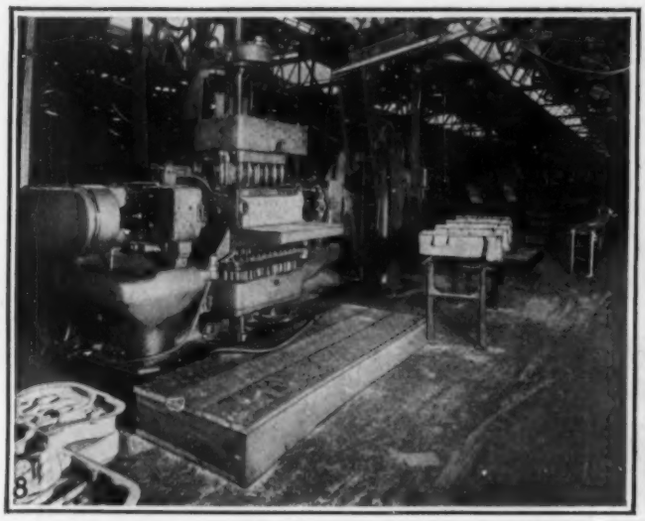

Fig. 4—Gravity conveyor bringing small parts to assembly floor. Fig. 5—Try-out gage for alignment of cylinder casting. Fig. 6—Cylinder blocks being conveyed to the Ingersoll milling machine. Fig. 7—Cylinder heads are machined four lines at a time. Fig. 8—Cylinder blocks being drilled. Fig. 9—Water pressure test

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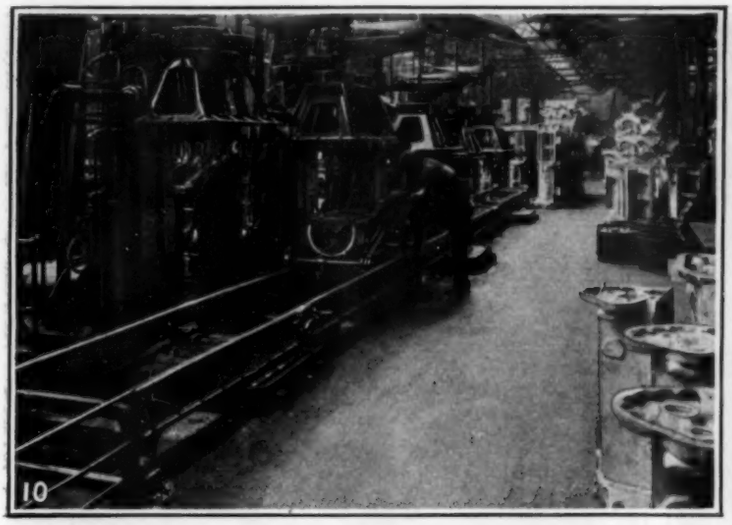

Fig. 10—The tram system for conveying the parts along the line of drills. Fig. 11—Milling crankcase-bearing faces

impression is one of solidity of thought behind each purchase. All tools are tried out before being purchased, and the finance committee must be satisfied that they are needed, either for improved quality or lessened cost of production. Sometimes a standard machine is bought, sometimes a highly special one, but all have the one financial or quality reason behind their purchase.

Continental makes engine units varying from four to eight cylinders and from sizes used on the smallest cars to those on the largest trucks and buses. It also makes engines for other purposes, such as material handling, concrete machines, earth handling, road making machines, pumping units and for other industrial purposes. This necessitates some degree of flexibility in the shop, and at first glance the shop would seem to be composed of a series of small shops each engaged in making its own type of engine. More detailed analysis shows, however, that the separate lines or compartments so dovetail into each other that a distinct unity of purpose is found actuating the whole, with the result that the plant must be considered as a unit.

One model of engine is produced at a rate of five each day. The most popular model is produced at a rate of 1,000 each day. Between these two lie many other models having varying production rates. The capacity of the plant is 1,800 engines a day. Each engine follows its own definite line through the shop and as indicative of the way it is handled, an example is given of the machining of a crankcase. The one line with small output has a simple milling machine equipped with a fixture having a capacity of one case at a time. The sequence of operations is to put the case in the fixture, then mill it, then lift the case out and replace it with another. In the other line where greater vol-

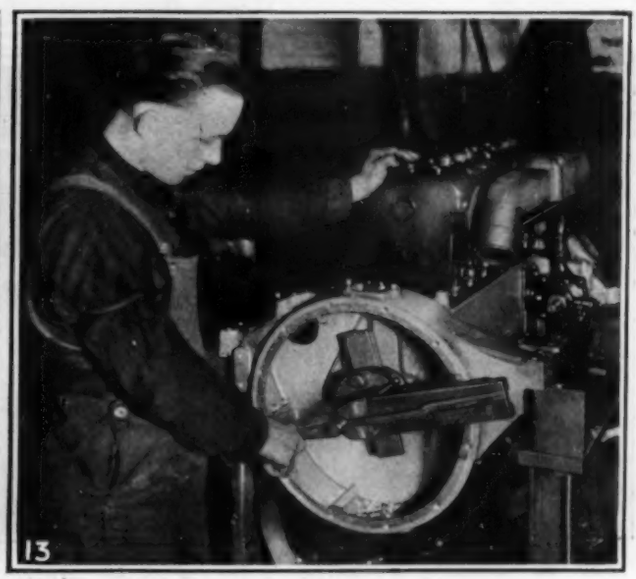

Fig. 12—Milling crankcase face. Fig. 13—Machining the bell housing face

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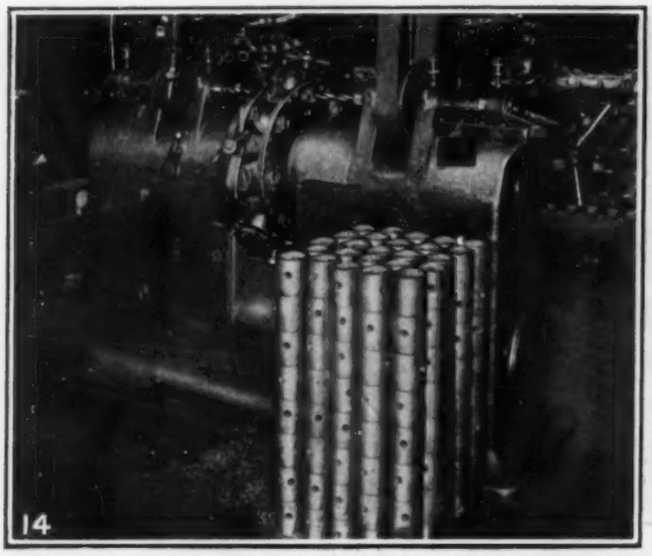
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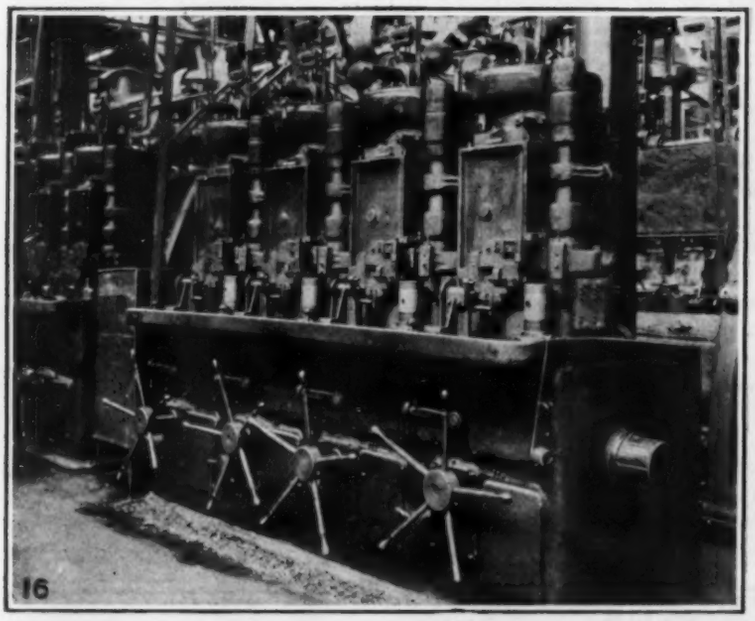
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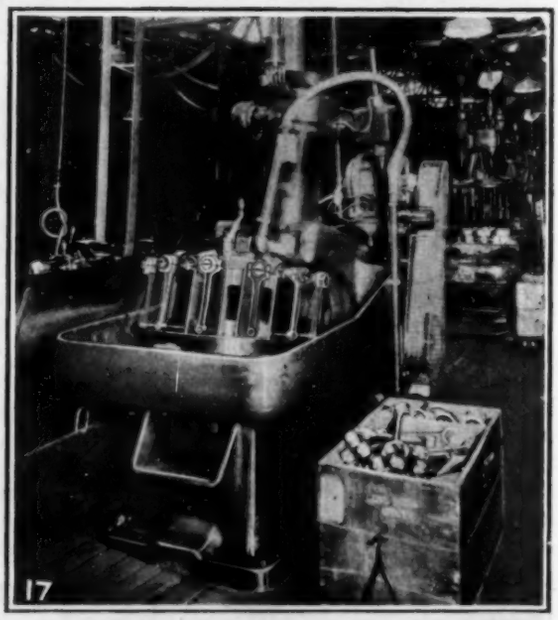
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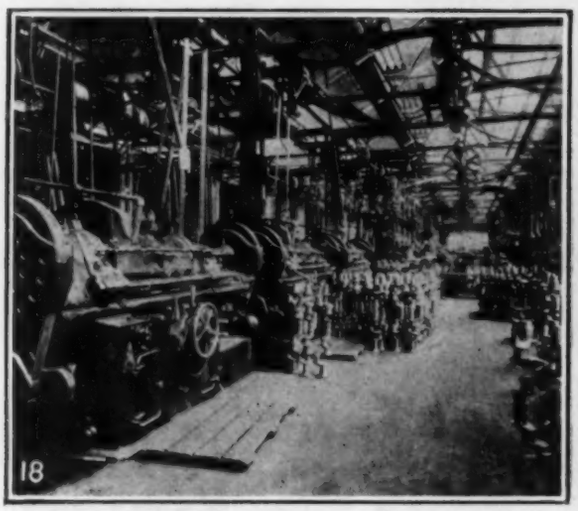
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Fig. 14—Drilling piston pin holes. Fig. 15—Another method of drilling piston pin holes. Fig. 16—Turning and grooving piston barrels. Fig. 17—Slitting connecting-rod bearing caps. Fig. 18—Crankshaft grinding department. Fig. 19—Balancing crankshafts on Olsen machines

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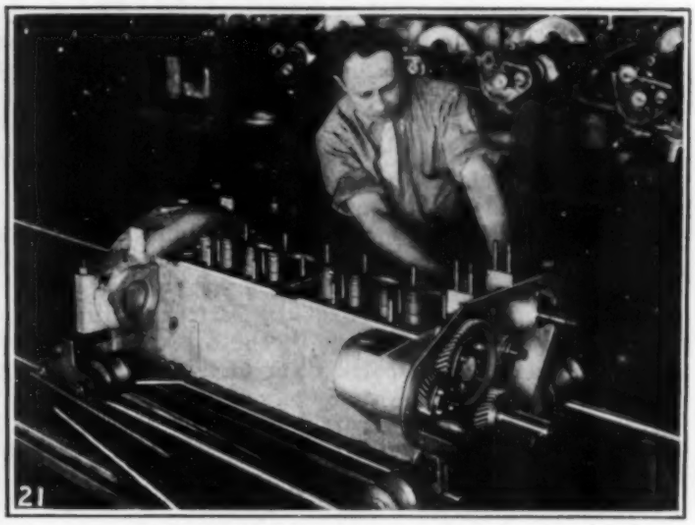

Fig. 20—Checking accuracy of crankshaft. Fig. 21—One method of assembling crankcases

ume is demanded the milling machine is of the Ingersoll type having roughing cutters on one side and finishing cutters on the other. Here the cases are loaded seven at a time, the loading being done while machining is under way, so the process is practically continuous. As far as possible this process is carried out so that machine capacity will balance closely with volume requirements.

The executives being specialists in engine construction, there has naturally been a tendency to favor specialization in shop operations. For this reason, men in the plant are grouped mainly into the following divisions: (a) part handlers; (b) machine setters; (c) tool setters or grinders; (d) maintenance men; (e) inspectors. Part handlers merely have the job of loading and unloading the machines. Their responsibility starts and ends there. Machine setters see that the tools are set right in the machines, that the speeds and feeds are correct and that the first job from the machine is satisfactory to the inspector. Tool setters are practically tool room men who keep the tools up to correct shape by grinding or resetting. Maintenance men see that belts are in good condition and repaired when necessary. They also take care of machine-tool overhauling and repairs. Inspectors fill their normal function of checking up on quality and dimensions. Johannson gages, shown in Fig. 2, are used freely for checking purposes.

In virtually every case, Continental men are paid by a gang system, even the sweepers and the men in the stock rooms. Only the planning and managing executives are paid straight salaries. Payment in the finished stock room is on the basis of the number of engines shipped a day. The stock room gang receives a daily budget accumulated at a given rate of so much a motor shipped. This budget is divided among the men. If it takes five men to do the work, they each get a fifth; if four men can do it, they each get a fourth. The shipping department is on the same basis. The heat-treating department, which may be considered

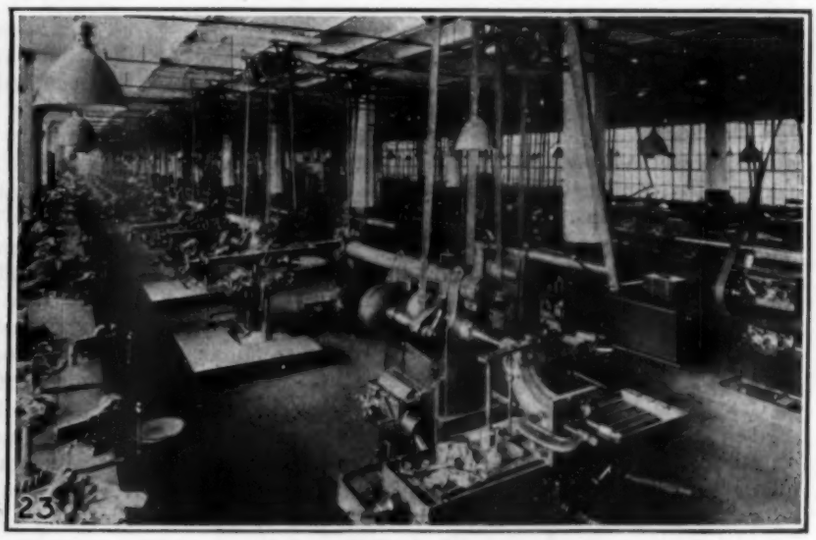

Fig. 22—Assembling engines. Fig. 23—About one-half of the tool room

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quite distinctly divorced from motor shipments, is nevertheless handled on the same basis too. This arrangement is fair to all and is one wherein each man is rewarded in direct proportion to the productivities of all men as a whole, and the reward is based only upon this recommendation, since it is based on motors shipped and not on motors built. Thus the reward is an incentive, not only to economic production but most important of all, to the maintenance of quality.

Conveyors are used extensively throughout the plant. One installation, shown in Fig. 3, is that which feeds the stockrooms from the receiving platform. An inclined traveling platform picks up the boxes of incoming material and transports them to the getting off stations. Another conveyor of the spiral-gravity, roller type, to be seen in Fig. 4, carries small materials down to the assembly floor.

Machining of a Cylinder Block

Coming now to the actual machining, a typical routing is of a combined cylinder block and crankcase of cast iron as follows:

Final inspection of rough casting on a special fixture. Rough and finish mill oil-pan contact surfaces, cylinder-head contact surface, side-plate contact, manifold contact and crankcase main-bearing slots. Drill oil holes top and bottom. Rough and finish mill both ends. First, second and finish-bore cylinders. Drill both ends. Drill valve openings. Drill and ream valve-stem guide holes. Chamfer cylinder bore at top and bottom. Tap both ends. Finish valve openings, valve-stem guide holes and valve-guide seats. Assemble studs for main bearings of crankshaft. Bore crank and camshaft bearings. Straddle mill bearings. Fit main bearing caps and bushings. Flycut crankshaft and camshaft bushings. Finish-ream camshaft bushings. Finish-ream cylinder bores. Finish-lap cylinder bores.

Cutting speeds vary with the nature of the work but 60 ft. per min. is a good average for cast iron and 240 ft. to a maximum of 400 ft. per min. is used for aluminum. Some of the high-lights in the processes are shown in the accompanying illustrations. Fig. 5 shows a target or try-out gage for the alignment of the rough casting. Note that it is mounted on a moveable truck so it can be changed in location if necessary. Cylinder blocks are shown in Fig. 6, on their way by conveyor to the Ingersoll milling machine.

Cylinder heads are machined as shown in Fig. 7, four lines at a time. Cylinder blocks are drilled, four faces at a time, on the multiple-spindle drill press shown in Fig. 8. In Fig. 9 is shown the testing for porosity or cracks by water pressure.

A tram-rail system for conveying parts along a line of tools is shown in Fig. 10. Note that the fixture, as mounted on the wheels, is capable of several movements to different locations around its own axis, so as to prevent new faces to the tools.

Crankcase bearings are milled as shown in Fig. 11 and the faces as in Fig. 12. The bell housing, or transmission face, is machined directly from the crankshaft of the assembled motor by means of the fixture shown in Fig. 13. Figs. 14, 15 and 16 show various operations on pistons, respectively they illustrate two methods used for drilling the piston-pin holes and lastly the equipment for turning and grooving the outsides of the pistons.

The method used in slitting away the bearing caps of connecting rods is shown in Fig. 17, the rotary station-to-station fixture giving practically a continuous operation.

The crankshaft grinding department is shown in Fig. 18; balancing is done in the Olsen machine shown in Fig. 19 and a simple inspection fixture for testing throws and alignment in Fig. 20. Assembling the crankcase is shown in Fig. 21. The complete engine is, however, assembled somewhat differently on an individual, moving platform as in Fig. 22. This makes for greater flexibility in handling many different models.

Fig. 23 shows part of the toolroom from which both the Detroit and Muskegon plants are supplied.

Finally there is an exceedingly simple but clever little fixture for assembling piston rings which can better be described than illustrated. It is made up of a small bench which stands upon the floor. The bench has a series of holes in the top. Each hole is of a diameter that conforms with the inside diameters of the several types of piston rings handled on that particular bench. Through the hole in the bench is a steel cylinder, the outside diameter of which for seven-eighths of its length is a nice general clearance diameter, with respect to the inside diameter of the piston ring. The top of the cylinder tapers out to a diameter just enough larger than the outside diameter of the piston so the ring will slip into place on the piston without any trouble. The process of asembling rings is simply a process of pushing the steel cylinder down through the pile of rings and down through the hole in the bench a distance each time equivalent to the thickness of the ring. The washers in the top of the cylinder, hold the piston in the proper location so when the cylinder is pushed out of the ring, the ring snaps into place in the piston groove.

Dollar Designers

By John F. Hardecker

There is but little question that there are available at all times a sufficient number of good "mechanical" designers and draftsmen. The majority of these men, if given unlimited time, can turn out a good design in the strictly technical sense. But how many are there who really, in addition to realizing the effect their time has on the cost of the job, also realize the necessity for carefully analyzing their designs on the basis of shop costs? In other words, how many are truly "Dollar Designers"?

The fault really lies with their fundamental education. Few technical schools and colleges try to instil in their men a true understanding of that very logical definition of an engineer, which I learned from an old college professor: "An engineer is a man who can do for one dollar what any damn fool can do for two." Why not make it incumbent upon the technical student to include a cost estimate with every problem or design he submits? Get him in the habit of thinking cost. Train him from the very beginning to develop his dollar sense—the money viewpoint. If this were done we would have more loyal, efficient and confident designers.

Replacement Troops for Our Industrial Army

By Herman S. Hall
Director, State Trade School, New Britain, Conn.

High degree of specialization in industry increases demand for experts—Effect of present immigration laws—Old apprenticeship system inadequate to meet the situation—Wide co-operation needed

THE increasing shortage of all-round skilled mechanics and tradesmen is generally recognized and progressive employers have realized, and the general public are beginning to realize, the seriousness of the situation sufficiently to begin consideration of means for increasing the supply of craftsmen. Some of the larger employers of labor and some communities are, and have for years been, making more or less serious attempts at offering adequate apprenticeship training; but the problem of training skilled tradesmen in sufficient quantities is still far from solved.

The high degree of specialization now required in some industries, far from diminishing the demand for expert tradesmen, has served to increase the demand. The specialist capable of only a limited number of operations requires tools, fixtures, machines, factories and transportation systems to enable him to continue his high production uninterrupted. Moreover the pendulum of specialization has begun the backward swing in many instances and the need for men of broader experiences and more varied abilities is recognized.

For years America has depended very largely upon Europe, with it's wonderful system for training craftsmen, for a very large portion of the artisans necessary as replacement troops in America's great army of skilled mechanics. The present immigration laws partially cut off this source of supply and make imperative a national scheme for training high-grade, skilled craftsmen to keep the nation's industries in the position of world leadership which is an absolute economic necessity if the present American standards of living are to be generally maintained.

Old-Style Apprenticeship Is Gone

Little help may be expected from apprenticeship as we used to understand the term. Here and there large industries are operating modern corporation schools and training some workers but the number is almost negligible when compared to the nation's requirements, and the number of corporations that can profitably operate such schools is limited.

Apprenticeship as we used to know it is dead. The causes of its death are many and vary somewhat in different localities and in different industries but the following reasons for the decline of the old system were rather general:

1. Boys were expected to act as errand boys, sweepers, etc., for a considerable portion of their apprenticeship. The excuse offered was that the boy thereby became acquainted with the trade. He did become acquainted with the most disagreeable parts of the trade and promptly quit if he could.

2. In only rare cases was any serious effort made to really instruct the boy. He absorbed what he could, asked questions according to his temperament and understanding and the disposition of the men he came in contact with and in general "stole" his trade in the face of obstacles, when he had every reason to expect help and systematic instruction.

Why the Boy's Training Was Poor

3. Increasing cost of overhead increased the production necessary from a boy if he were to continue on the payroll without a direct loss to his employer. This led to the holding of the boy on a given type of work, once he had been broken in to it, and prevented his being rotated from operation to operation and thus his mastering of the various operations of the trade one after another as fast as he was capable of learning them.

4. It became an accepted theory with the general public that four years in a high school spent in the study of college preparatoroy subjects, in some miraculous way, fitted a boy to land right side up in whatever vocation fate happened to drop him. In addition the false notion that high school attendance placed a boy on a higher social plane than entering upon an industrial career via the apprenticeship route prevented many boys from entering industry.

5. The very great increase in the general knowledge of science, mathematics and drafting, required by industry of its skilled men, added responsibilities to the employer of apprentices; and these responsibilities he not only refused in most cases to accept, but was not at all fitted to discharge. The shop-trained apprentice had to look outside of the shop for training in important parts of his trade if he wished to become a high-grade tradesman or fit himself for even modest advancement. This naturally reacted unfavorably towards the system.

6. The restriction of apprentices by labor organizations was a large factor in the decline of the apprenticeship system. In many trades the labor organization insisted upon passing upon all apprentices taken on by employers and, by the simple expedient of refusing to approve of any names presented, stifled apprenticeship.

7. In recent years the high wages paid for the performance of relatively quickly learned though monot-

onous and character-dwarfing specialized operations has operated against the serving of an apprenticeship of several years to become an all-round tradesman, whose financial reward is oftentimes less than that of the "operationist" or so-called specialist.

An analysis of these factors shows that every party concerned, employer, labor organization, the apprentice himself and the general public contributed toward the collapse of the apprenticeship system. The employer failed to offer real training in most cases; labor organizations were largely unsympathetic if not actually hostile; the apprentice overlooked the value of the training he was to receive and demanded wages on a par with those paid in "dead end," unskilled jobs offering no future; the general public placed a faulty social value on "white collar" jobs and the training for them.

Since all parties concerned were contributors to the downfall of the old system it is reasonable to suppose that any future scheme of training craftsmen, to be thoroughly successful, must meet with the approval and have the active support of all concerned.

No Halfway Measures Can Succeed

If the new plan to be worked out includes the training of future mechanics wholly within the industries, then industry must see to it that real training is offered, wherein the boy progresses as rapidly as is commensurate with economy of operation; training wherein the boy learns all parts of the trade; and training that includes the related work of work-a-day science, mathematics and drafting and some education for citizenship. If the new plan includes, largely, training in public schools then industry must be sympathetic in the matter of advice and must be co-operative in furnishing work to the educational institution in order that training may be given through the execution of actual trade operations; and industry must be fair in the placing of boys trained and in the remuneration of the men who have spent three or four years in the learning of a trade.

To be successful any plan should meet with the approval of labor organizations or at least should not incur their enmity. Experience shows that if real training is given and reasonable precautions are taken to prevent an over supply of skilled men in any given craft, labor organizations are not inclined to look with disfavor upon the training of apprentices.

Before the support of the general public may be expected for any plan, people generally must be led to give a proper social standing to those preparing, through apprenticeship, for industrial careers; the confidence of the youth of the country must be re-established in the value of training for craftsmanship; and youth must be satisfied with wages commensurate with productive ability during the training period, in view of the future earning capacity and of the opportunity for advancement for all-round tradesmen.

Much Publicity Work to Be Done

Securing the confidence of youth and getting the general public to revise its social evaluation scale is a matter of publicity to be carried on consistently over a period of years. Sufficient data and facts are readily available for such a campaign which should be carried on through trade publications, newspapers, magazines and all other sources known to the professional advertiser. The campaign should be simple and direct in its appeal and must be carefully planned to avoid too great a shock to old traditions.

Every assistance must be given to the development of real vocational guidance in the schools in order that youth may have the benefit of scientific advice in selecting vocations. The influence of the "old maid school marms," both those in petticoats and those in trousers, has always been to encourage all boys whose brains functioned normally or above normal to enter only the so-called "professional" vocations. Fortunately this type of teacher is no longer in demand and with the development expected in vocational guidance this influence will be entirely offset by well-trained counsellors who will be able to offer really valuable advice to boys and girls at that important life period between the ages of 12 and 18 when a vocation should be chosen.

In view of the present trend of legislation and economic urge it appears possible that a plan may be worked out whereby the future mechanic will receive instruction in operative work and in the science, mathematics and English directly related to the trade chosen, as well as instruction in practical citizenship studies, during his 14th, 15th, and 16th years in a public institution and will continue his training for one or more years while remuneratively employed in an industrial plant under the joint supervision of a representative of the school and the industry employing him. The success of such a plan will be dependent upon co-operation between educators and industrial officials. Industrial officials must be made to understand that educators no longer regard education as being solely the pursuit of formal "mental discipline" subjects and the acquisition of unapplied knowledge and disassociated facts but that the present aim of education is training for life, for living and taking an active part in the industrial, social and political life of today. Educators must realize the changed viewpoint of industry with its modern, broad, sympathetic treatment of human relationship and social welfare problems.

With the co-operative efforts of the public schools and industry receiving the stamp of approval of public opinion, a successful plan can surely be developed for the training of skilled mechanics, and thereby the well being of both the individual and society promoted, for, as Plato said over 2,000 years ago, "The abilities of the individual should be ascertained and developed as largely as possible, as thereby the happiness of the individual will be promoted and the social and economic needs of society best served."

Standardizing Radio Apparatus

Five technical working committees to study plans for standardizing radio receiving apparatus, have been appointed in connection with the work of the American Engineering Standards Committee. The committees and chairmen are: Transmitting and Receiving Sets and Installation, Arthur Van Dyck, Radio Corporation of America; Vacuum Tubes, C. B. Joliffe, Bureau of Standards; Electro-Acoustics Devices, Lloyd Espenschied, American Telephone & Telegraph Co.; Power Supply and Outside Plant, L. W. Chubb, Associate Manufacturers of Electrical Supplies.

Each of the committees will undertake a standardization of nomenclature in its own field. There is also a sectional committee containing official representatives of twenty national organizations.

Maintenance of Rolling Stock on New England Railroads

By Ellsworth Sheldon
New England Editor, *American Machinist*

Pouring bronze facings on driving boxes—Car-wheel and axle work—Headlight and car-lighting generators—The air-brake department

THE practice of the Waterville shops of the Maine Central R.R. in facing locomotive driving boxes where they abut against the hubs of the driving wheels, is to cast the metal in place. To prepare it for the casting operation the box is strapped to the table of a boring mill, trued up to align approximately with the bore of the crown brass, and a dovetailed circular groove cut in its side to a depth of about ⅝ in. and as wide as the space will permit. Shallow anchor holes are drilled in the bottom of the groove to prevent the casting from being moved by the friction of the wheel-hub when it is in service.

When a sufficient number of boxes has been thus prepared to warrant firing up the brass-melting furnace, they are laid out on the floor of the casting room —which in this case is a corner of the blacksmith shop—molds are built up around them and the metal poured in from hand ladles. The material used is manganese bronze and the melt consists of the chips made in the machine shop when machining crown brasses, with occasional pieces of old crown brasses added when the quantity of chips is not sufficient for the job in hand.

The "molds" are made by clamping iron formers to the faces of the boxes and centering them with the bore of the crown brass roughly to shape the periphery of the cast, setting short boards in the open ends of the boxes and backing them up to stand upright by means of the binder bolts, and filling the open spaces inside the boxes with molding sand. Odd pieces of asbestos lagging—discarded in the locomotive shop when boilers are newly lagged—and lumps of fireclay are used to make the molds tight. The metal is melted in the tilting furnace to be seen at the right in Fig. 1 and is taken thereform in hand ladles for pouring.

Boxes that have become worn in the channels where the shoes and wedges bear, have about ½ in. planed off the worn surfaces, anchor holes drilled in them and bronze poured on in the same manner. The molds are open at the top in all cases and the metal is poured to a considerably greater depth than is needed to build up the box, so that in the machining operations that follow a sufficient quantity of stock will be removed by the tools to ensure sound and homogeneous metal at the bearing surfaces.

The car-wheel and axle job is in a building that was put up to enclose the space between the locomotive and the car shops. It is accessible through an open archway from the machine shop bay and by a wide door from the car shop. A track leads into the room from the transfer table outside and is the means by which old sets of wheels are delivered to the job and new ones rolled out.

The forcing press, shown in Fig. 2, stands at a right angle to the track and therefore necessitates a movement sidewise of the wheels to bring them in line to be rolled into the press. To make this move without undue effort and loss of time, the little transfer table shown in Fig. 3 was built; it has worked out very well.

Fig. 1—Pouring bronze facings on driving boxes

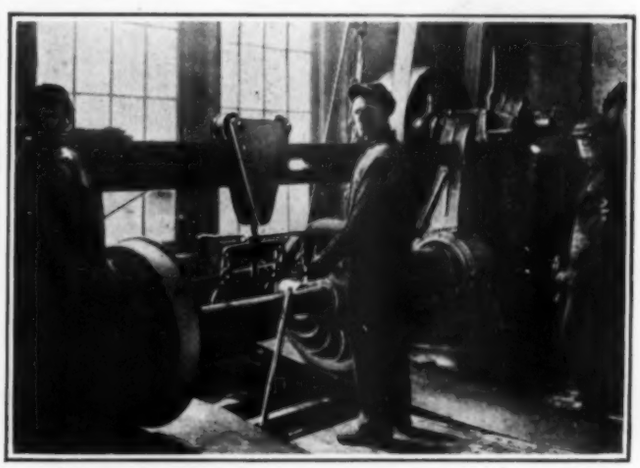


Fig. 2—The car-wheel forcing press

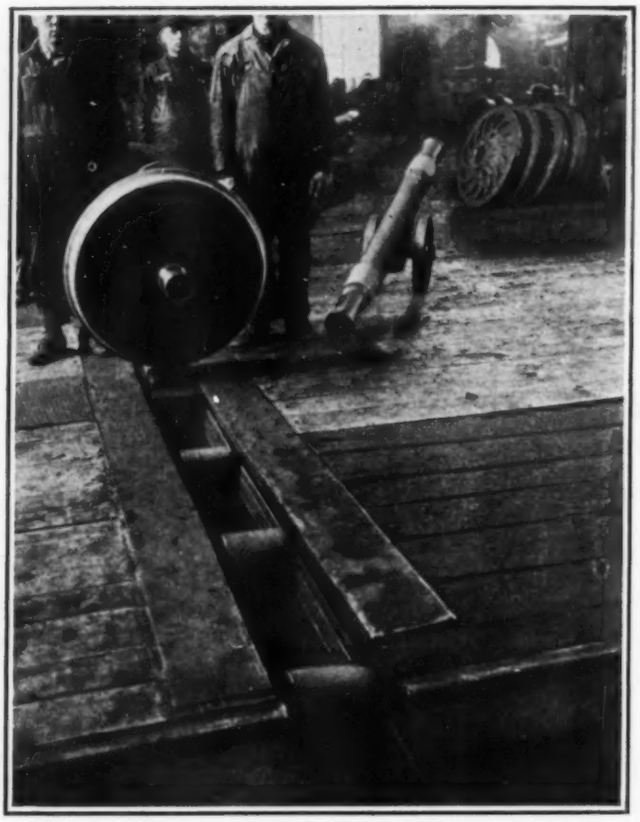


Fig. 3—Transfer table to serve the wheel press

A channel beam is embedded in cement below the floor level and rollers of a suitable diameter and length to roll in the channel are laid in it. A small turned shoulder on each end of all the rollers enters a corresponding bearing in flat plates set edgewise at each side of the channel, so that the rollers are held parallel and in uniform relation to each other, very much as similar rollers would be held in a roller bearing. A plank, faced with metal on the under side and having attached to its upper surface two short sections of rail corresponding in gage to a standard track, rests upon the rollers.

One rail of the track upon which the wheels are rolled into the room may be seen in the foreground of the illustration. The gap in the rails is no wider than is necessary to allow the flanges of the wheels to clear the ends of the fixed rails as they are moved sidewise (endwise of the axle) out of the track. With the table in place to bring the short sections of rail into line with the track rails, the wheels are rolled on and the table pushed endwise to a position before the press, the rollers and cage moving with it but traveling only half the distance. The length of the cage of rollers must be half the distance traversed plus the length of the table. Very little effort is required to make the move.

Two car-wheel boring mills with cranes for loading and unloading them are located in the same room with the press, as are also the axle lathe and the lathe for turning the treads of the wheels after they have been forced on to the axles. One mill is used exclusively to bore cast-iron wheels and the other bores all the steel wheels. Fig. 4 shows the latter machine.

The boring bar to be seen in the illustration carries both single- and double-end cutters, held in the bar

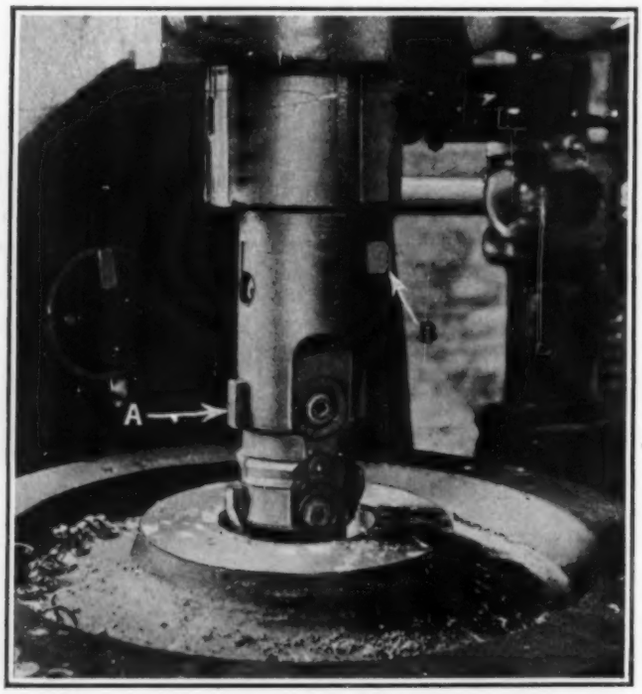


Fig. 4—Car-wheel boring mill

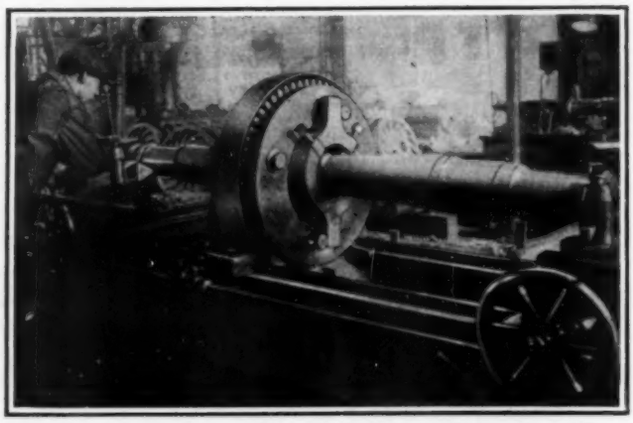


Fig. 5—Double-end axle lathe

by pointed setscrews that serve to locate them with reference to the diameter of the bore. The rough bore is made in two cuts, by changing the tool at the lower end of the bar, while the tool at *A* finishes it to exact size. After this tool has passed through, the tool at *B* is brought down to chamfer the corner. A horizontal slide carrying a facing tool then comes forward from the face of the column and faces the hub.

Pressures ranging from 40 to 60 tons are exerted to force on the cast-iron wheels, and the pressures used on the steel wheels range from 60 to 80 tons. Wheels for new axles are bored to standard sizes and the fitting is up to the man on the axle lathe. Old axles are redressed to clean up and the boring mill operator must bore the wheels accordingly.

New axles are turned on the Niles-Bement-Pond double-end axle lathe shown in Fig. 5, and as many old ones redressed as the operator has time to handle. The overflow goes to engine lathes in the machine shop. The rolling method is employed to finish the surface of the journals.

The Pond car-wheel lathe shown in Fig. 6 turns the

treads and forms the flanges on the wheels after they have been forced on the axles. In this lathe the axle swings on dead centers carried by the heads at the ends of the lathe bed and is driven by faceplates back of each wheel. The driving spindle takes its power from a gear under the cover *A* at the center of the machine. The gear is large in diameter and is slotted from one side so that it is of U-section, the slot being sufficiently wide and deep so that when the axle is on the lathe centers the centerlines of axle and spindle are coincident but the axle does not touch the spindle.

To get the combined wheels and axle into and out of the lathe it is necessary that the driving plates and the spindle bearings—one of which may be seen at *B*—shall have open sides corresponding to the slot in the spindle, and that a segment of the gear shall be removable. The open-side bearings would not be strong enough to withstand the pressure of the cut without reinforcement and are therefore tied together with slip-bolts when the machine is in operation.

The view of the lathe in Fig. 6 is taken from the rear with a pair of wheels being swung out. The machine is set in a pit, so that the operating position is considerably lower than the floor level upon which the men are standing. There are two carriages so that work may be done upon both wheels at the same time.

The electrical department handles all the repair and maintenance work on the train and locomotive systems as well as upon the electrical equipment of the shops. The steam turbo-generators that supply current to light the locomotives and the belt-driven generators that perform a similar service for the cars are taken apart, cleaned, repaired when necessary and restored to service condition. The storage batteries, control mechanisms and other details that pertain to the system are given proper attention to keep them in working order.

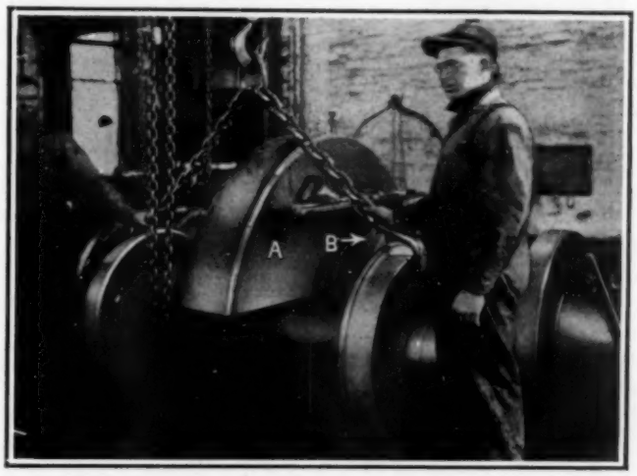


Fig. 6—Turning treads of car and pony-truck wheels

Several types of generators are used upon the locomotives. Figs. 7 and 8 show a "Sunbeam"; the first illustration with the cover swung open, as may be done upon the road to make minor adjustments, and the second with the outer case of the turbine removed, exposing the rotor. These machines are very simple and beyond the renewal of the vanes in the rotor and the substitution of a new bearing occasionally, they need little in the way of repairs.

On the electric end, the commutator may need redressing from time to time and new brushes have to be put in. The principal requirement is cleaning, and for this job the generator is taken apart and such pieces as can be so treated are sent to the potash tanks. The winding is inspected, joints resoldered if necessary, tested for "grounds" and the machine reassembled. The generators are interchangeable to a certain extent in their positions upon the locomotives and several of them are kept ahead of the demand so that any engine may be supplied at short notice.

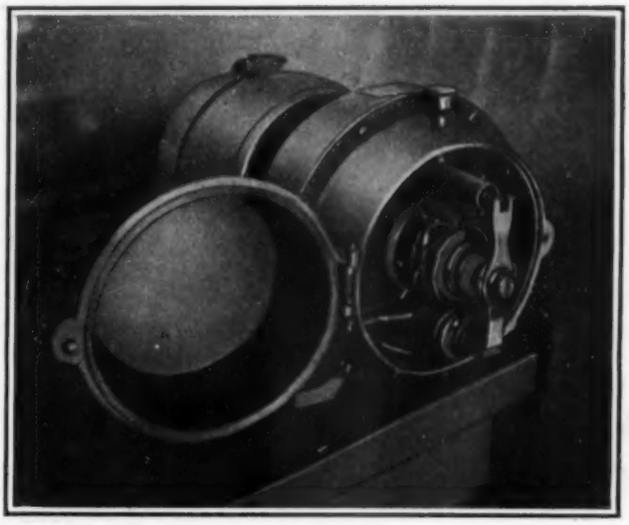


Fig. 7—"Sunbeam" turbo-generator for locomotive lights

One of the most complicated, and at the same time most dependable, details of modern railroading is the system of air-brakes, without which no passenger train and few freight trains leave the yards. From the compressing plant on the locomotive to the last valve on the rear end of the train pipe, it is a maze of delicately balanced mechanisms that are little understood and not at all appreciated by any save those who are brought into daily contact with them.

The air brake is one of the few mechanical devices that "operate by failure"; that is to say, the train does not depend upon the proper functioning of the brake mechanism to stop it, but to keep it moving. The brakes are normally "set," and a train cannot be moved until the perfect working of the braking apparatus, under the impulse of compressed air from the locomotive, has released them. Moreover if anything happens

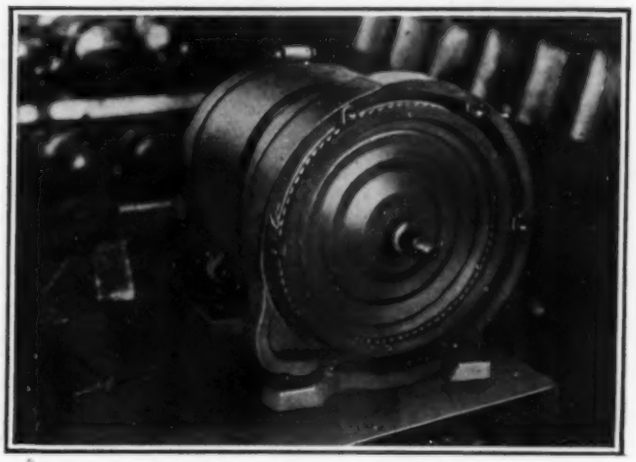


Fig. 8—Steam end of generator with case removed

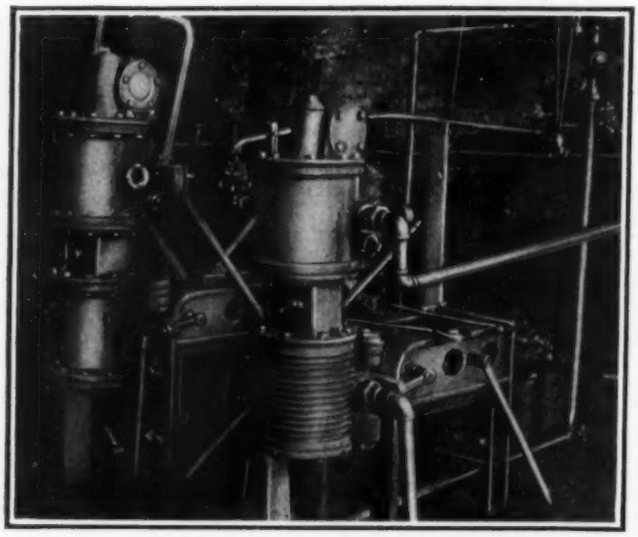


Fig. 9—Air pumps on the testing stand

to any part of the apparatus while the train is running, the brakes will automatically be applied and the train brought to a standstill.

The power generating member of the apparatus is the compressor—commonly called the "Westinghouse pump"—carried on the side of the locomotive. All engines have one, and many of the larger ones two of these pumps; some single and others compound. In the air-brake department of the Waterville shops the pumps are taken apart, cleaned, repaired, parts replaced where necessary and reassembled. They are then tested for a stated period of time under conditions paralleling those to which they will be subjected in service. Fig. 9 shows two of the pumps on the testing stand, ready to undergo the testing operations.

Modern locomotive boilers carry high pressures, and to test the pumps under service conditions means that higher pressures than are available from the power house boilers must be maintained. For this purpose the air-brake department has a special boiler, that has a

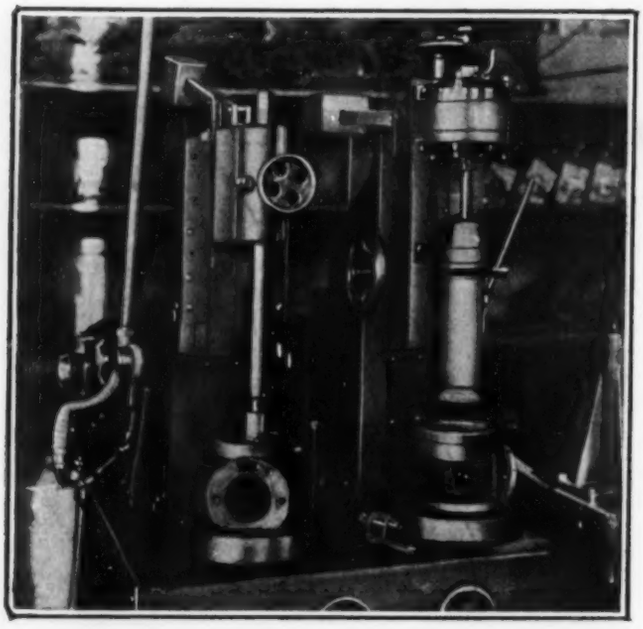


Fig. 10—Grinding and lapping pistons of triple valve

safe working load rating of 200 lb. per sq.in., and any pressure up to that limit may be carried for the purpose of the tests.

When a pump is set up on the stand for testing, its delivery pipe is connected to the shop air mains and the pump allowed to run at full working speed for a half hour or so, delivering air against the pressure of the mains and thus conserving the energy generated by the testing boiler by relieving the power house compressor of a part of its load. When the tester is satisfied that the machine is in good working order he disconnects it from the air mains and couples it to a small tank that corresponds to the air reservoir of a locomotive.

Standard air-brake apparatus, controlled by the regu-

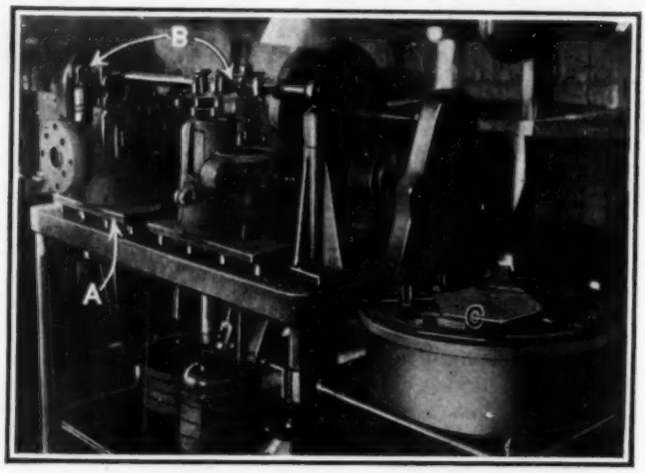


Fig. 11—Lapping slide-valves and valve seats

Fig. 12—Lapping angle plug-cocks

lar "engineer's valve" is connected to the small tank, and for the duration of the test the tester stands with one hand on the valve while in the other hand he holds a watch. With his eyes upon the gages and the timepiece he alternately goes through the motions of setting and releasing the brakes, noting the number of strokes per minute made by the pump under various pressures and how long it takes to build up to normal pressure after the brakes have been applied for "service" and "emergency" stops. All of these points are standardized, and the pump must meet all requirements before it is passed along to the locomotive shop to be mounted upon an engine.

The "triple-valve," one of which is located under every car and controls the braking apparatus for that

car, contains a small slide valve and a differential piston; a piston having train-pipe pressure on one side and reservoir pressure on the other. The piston must be tight under the 200 lb. air pressure ordinarily employed, and no small part of the duty of the air-brake department is to keep it so.

The machine shown in Fig. 10 is a grinding and lapping machine for reconditioning the cylinders of triple valves and lapping in new pistons. The valve bodies are in each case strapped to a rotating faceplate. On the column to the right, a small electric motor is mounted on the vertical slide and carries a grinding wheel at the lower end of its extension shaft. The slide is adjustable sidewise to feed the wheel to successive cuts. The slide on the column to the left has a reciprocating vertical movement equal in range to the travel of the piston in the cylinder, and a piston is attached by a floating connection to the fixed bar.

In Fig. 11 may be seen a machine to lap the small slide valve which is a part of the triple-valve mechanism. The valve bodies are strapped to fixed plates *A*, and small cast-iron laps are attached by suitable connections to the rock-levers *B*, which are reciprocated by eccentrics on the shaft at the rear of the machine. The laps are of approximately the same size and shape as the slide-valves and are held to the seat by a wire spring.

The actual valves may be seen on the rotary lapping plate *C* at the right of the machine. This plate revolves constantly and the valves to be lapped are set into cut-out openings in a stationary spider so that the plate revolves under them. Their position on the moving plate is changed frequently by the operator, who is constantly picking them up, turning them around and transferring them to other openings in the spider, thus insuring flat surfaces.

Another detail that is handled in vast quantities is the angle plug-cock, one of which is located at each end of the train pipe under every car so that the brakes of that car may be cut out when the car is to be detached from a train. The valve bodies are shown on every station of the machine in Fig. 12 except the second from the left. A body is set into a locating fixture as at *A* and clamped down by a movement of the eccentric lever *B* at the top of the fixture; the corresponding plug having previously been set into the square socket of the spindle in the center.

The spindles have a reciprocating motion, both circular and vertical. The conical plug is held in contact with its seat by the coil springs of the fixture while it makes a partial turn, when it is withdrawn slightly by the spindle, turned back nearly to the starting point and the movement repeated. The circular movement is progressive, so that the plug does not start to turn exactly in the same place each time, thus forestalling the tendency to grind rings in the plug and seat. The machine is driven continuously by the small motor on the floor at the right, but each station is independently controllable by a clutch lever on the front of the machine.

Manufacture of "Malleable" Nickel and Nickel Alloys

In the manufacture of "malleable" products of nickel and certain nickel alloys—such as forgings, rolled shapes, and castings—rather unusual metallurgical treatments of the molten metal are resorted to in order that the cast product may be sufficiently malleable and ductile for the subsequent forging operations, says an article in Technical News Bulletin No. 93 of the Bureau of Standards. The principal features of these treatments are the addition to the molten metal before casting, of small amounts of the metals magnesium and manganese. Nickel, without these additions, is not malleable either hot or cold, and will smash to pieces when hammered instead of squeezing out into the form desired.

Such "untreated" nickel, and nickel alloys, are brittle because of the presence of tiny amounts of sulphur, as little as one part of sulphur in 20,000 of nickel being sufficient to spoil the material. This sulphur comes from the ore which originally contains far more sulphur than it does nickel, all but this tiny remnant of sulphur being removed in the refining process. The sulphur is combined with the metallic nickel as a compound which collects in the form of thin and brittle films around the grains of nickel. This compound melts at a low temperature—hence the cohesion between the nickel grains is impaired by the presence of these films, brittle when cold, and, of course, having no strength when melted, and the metal containing such films is brittle and unworkable either hot or cold.

In an investigation just completed under an Industrial Fellowship at the Bureau of Standards, maintained by the International Nickel Co., it has been found that manganese and magnesium react with this harmful compound of nickel and sulphur, taking the sulphur away from its combination with nickel, and making new compounds of the sulphur with the manganese or magnesium. The new compounds have a high melting point and in addition take a form which affects the malleability but slightly. This form is made up of small particles uniformly distributed throughout the metal grains, instead of films in the metal mass.

Famous Machinists of History

By H. H. Manchester

Jean Godin (1817-1888)

Jean Godin was born at Esquehéries, in Aisne, France, in 1817. His father was a locksmith in ordinary circumstances. Jean entered the iron works there when a mere boy and remained until he was about seventeen. He then traveled over France as a journeyman iron worker for several years.

In 1837 he returned to Esquehéries and started a small factory of his own for making castings for heating stoves. The business prospered, and in 1846 he transferred his factory to Guise, where he established a much larger plant.

In 1871 he was elected deputy for Aisne, and continued as such for several years.

By 1880 both the business and the social organizations were decided successes, and all of the business and the tradesmen were turned into a co-operative society.

Two years later he was made a Knight of the Legion of Honor. When he died in 1888 the output of the factory was about $800,000 per year.

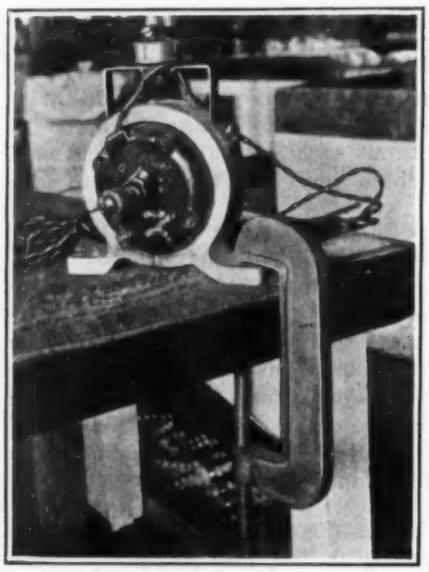
Ideas from Practical Men

The department, "Ideas from Practical Men" is devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

An Improvised Bench Drill

BY HENRY C. FRANCIS

A convenient portable drilling machine for use in many places where burred holes have to be cleaned out, or in similar work, is shown herewith. It is a small motor of perhaps ½ hp. that came out of a Hoover vacuum cleaner and has been mounted in a ring casting, with feet and also a handle at the top. A drill chuck is mounted on the end of the shaft and carries any small drill suitable for the work in hand.



Motor for drilling

The handle makes it easy to carry to any desired bench where it can be plugged in on the light circuit. The feet enable it to be clamped to the bench at any place or at any angle. The switch is on the handle and makes the whole unit complete in itself. It has been found very useful in the Hoover shop at Canton, Ohio.

Air Blast for Cooling Cutters—Discussion

BY WILLIAM DENTON

In regard to the use of an air blast to keep cutters cool, as told by Donald A. Hampson on page 171, Vol. 62, of the *American Machinist*, the writer knows of one case where this scheme was tried with results that were most unlooked for and disagreeable.

The blast was taken from a small centrifugal fan located under the floor of the machine shop in a space about 3 ft. high that was enclosed by the foundations of the building. The main purpose of the fan was to blow the fires in the blacksmith shop, but as the fires were in another building at some distance from the machine shop, there was no smoke or dust in the intake and the air was quite clean. I do not know what the pressure may have been, but it was probably no more than the 6 oz. cited by Mr. Hampson.

The experiment was successful so far as keeping the cutters cool was concerned, but after a few hours run we discovered that the machine was coated with a fine, impalpable dust of cast iron that had settled upon all surfaces, impartially as far as location was concerned but, of course, more noticeable where the surfaces happened to be oily.

Aside from the disagreeable feature, the dust was a positive menace to the machine, since it worked into the bearings of rotating parts and made itself particularly obnoxious upon the exposed sliding bearings of the saddle and knee.

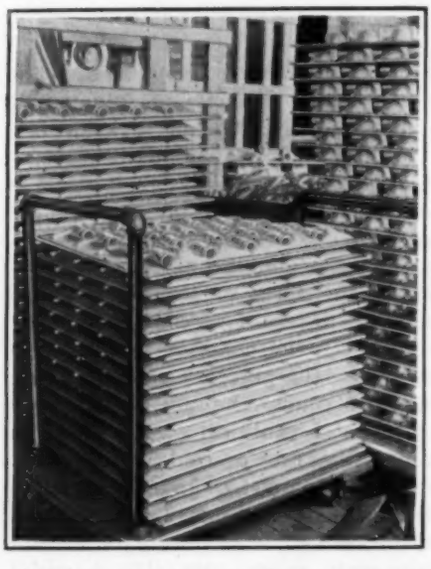
The scheme was abandoned at this stage, but I have often thought that the trouble could have been obviated by rigging up an exhaust hood as nearly opposite as convenient to the air jets. As a cooling medium the air left nothing to be desired.

Storing Sweeper Parts

BY CHESTER H. FRANKLIN

The modern carpet sweeper is composed of quite a number of parts, mostly aluminum, and when manufactured in large quantities it becomes necessary to store some of these parts between operations. The method illustrated herewith is used very successfully by the Hoover Co., North Canton, Ohio, for storing quite a variety of parts which lend themselves to being handled in the manner illustrated.

The trucks shown make very convenient storage, and at the same time allow the easy transportation of parts to the assembling department. The construction of the truck may readily be seen from the illustration. It will be noted that the railing on the end serves the double purpose of lining up the boards on which the parts are packed and facilitating the movement of the truck.



Method of storing sweeper parts

IDEAS FROM PRACTICAL MEN

The boards are of heavy strawboard, and each edge is bound with zinc, riveted in place. The soft stawboard does not mar the work in any way and, in fact, acts as a sort of cushion as the various layers are piled on each other. This method of stacking and protecting also makes it easy to count the pieces, each board accommodating a definite number of pieces.

Direction Indicators for Crane Controls

By E. F. Creager

Many shops have small motor-operated cranes and hoists that are controlled from the floor by means of hanging ropes to which D-handles are attached, and few of these handles are supplied with indicators of any kind to show which rope to pull to raise the load and which to lower it. I wonder how many of your readers have been hit in the jaw by one of the handles that a careless operator had allowed to swing?

I have had this experience, and the blow jarred my thinking apparatus just enough to make me decide that if the handles were to be made of aluminum they wouldn't hit so hard. Then a really bright idea struck me. I would make a couple of patterns for aluminum handles with an arrow head on each; one arrow to point up and the other down. Fig. 1 shows the resulting castings.

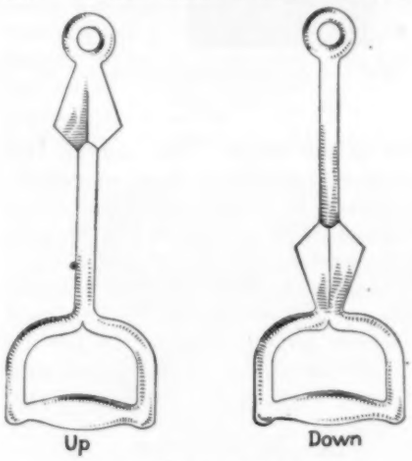


Fig. 1—The original idea

This worked out fine, but the gang got tired of being hit in the head, even with aluminum handles, and one day I found that some bright kid had cut the ropes about three feet above ordinary head height, tied the handles to the shortened rope and fastened a short piece of braided sash-cord on each, as shown in Fig. 2, with a good sized knot at the lower end. This was easier on the heads.

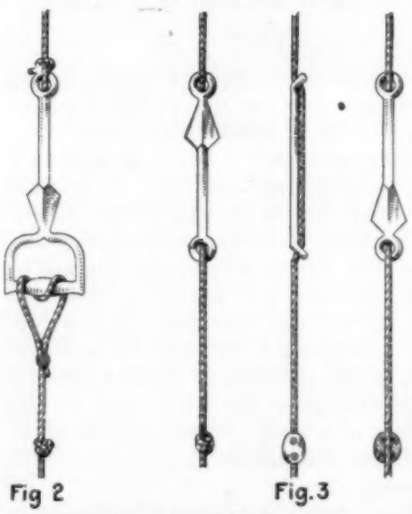


Fig. 2—What the kid did. Fig. 3—The present arrangement

The suggestion of the kid's example seemed a good one, so I had a pattern made for an arrow with a ring in both ends for the pull rope. One pattern only was needed, as the arrows could be tied into the rope either way up, or, as indicated in Fig. 3, the rings could be bent slightly and the rope passed through both without the necessity for cutting it.

The knot on the end of the rope did not look quite tidy, so I had some wooden "bobs" made in two parts, to be fastened together with a couple of long slim screws to clamp on the rope, making a neat looking and "Safety Code" job. For travel direction a couple of arrows cut out of sheet aluminum and fastened to the frame of the crane adjacent to the respective pull ropes indicated which rope to pull to "go south."

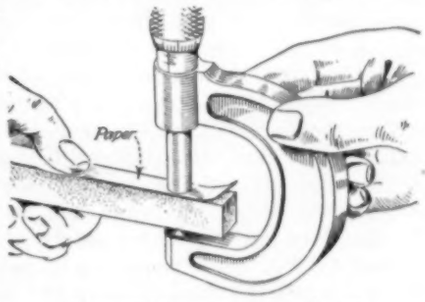
Everybody was happly with this arrangement until Frank, who was running the big planer, forgot to loosen the clamps on his job before he pulled the rope, and the bed was lifted clean off the planer. What I am looking for now is some sort of device to be attached to the ropes that will loosen the clamps before the load starts to rise. I havn't figured out yet just what it will be, but I have a hopeful eye on the kid. Maybe he will help me to "evolute" something.

Repairing Micrometers

By H. J. Gustav Kopsch

Notwithstanding the common employment of snap and ring gages and other gaging devices, a great deal of the work ground on cylindrical and centerless grinding machines has still to be measured by means of the ordinary "mike"; especially in shops where there is a large variety of work to be ground, and in lots not sufficiently large to justify the making of special gages.

Most of the operators, even though they may be experienced, never become accustomed to using the micrometer "all over"; by which expression I mean that they use it always in the center and at a right angle to the work to be measured. The result is that after a comparatively short time the anvil is worn hollow. The spindle does not suffer so much, since it revolves and presents a different line of contact each time work of different diameters is measured.



Correcting worn anvils of micrometers

When the operators check their micrometers with a standard (unless the standard be a disk) the error is not detected and the fault remains unsuspected until their work begins to be rejected because of being oversize.

The best way to overcome most of the trouble is for the operator to get used to presenting the micrometer at various angles when measuring round work, and especially to avoid using it in the manner of a C-clamp, as some of them are inclined to do. The remaining

IDEAS FROM PRACTICAL MEN

trouble I usually correct by the use of a flat, parallel "india-stone," followed by an oilstone. Both of these stones I keep among my tools for just this purpose.

I hold the stone between the thumb and index-finger, placing a strip of thin but stiff and smooth paper between the stone and the spindle of the tool to prevent abrasion at this point, and close the micrometer just sufficiently to permit the stone to slide back and forth. I then rock the frame gently from side to side as if the spindle and anvil were a fulcrum, at the same time keeping the spindle always fairly tight and constantly changing the position of the anvil along the stone to prevent the wearing of a low spot in the latter.

In a few minutes' time the anvil is lapped flat and parallel with the face of the spindle. The process is then repeated with the Arkansas stone in order to obtain a fine finish. After the anvil is as good as new, it must be readjusted so the spindle will stop at the zero mark.

The paper between the stone and the face of the spindle prevents any damage to the latter and also reduces the friction. The entire job requires less time to perform than to describe.

Make More Use of Available Equipment

BY W. EDWARD

It was decided to install an overhead conveyor system in the assembling department of an automobile frame-making company. As there was urgent need for this installation, the construction foreman was given but two weeks to complete the job.

The principal difficulty, found at the start, lay in digging through some six or eight inches of concrete flooring, reinforced with Frost wire fencing, in order to set sixty uprights in solid foundations. In the time allotted, the use of ordinary means of getting through this concrete with a limited force of men was obviously impracticable. It was, therefore, necessary to find a way to do the work with dispatch.

The installation was in a part of a building, 600-ft. long by 80-ft. wide, served by a 15-ton traveling crane, and as the foreman, who was a particularly versatile chap, studied the situation, he thought out a solution to the problem. Going to the neighboring foundry, he borrowed a skull-cracker and its trip mechanism. He next laid out the center points of each of the holes he had to dig, after removing a patch of wood block which formed the flooring over the concrete. Then by centering the skull-cracker over each hole in succession, it was lifted with the crane and tripped from a height of approximately 15 ft. A single drop over each spot so shattered the concrete that the wire mesh could be reached and cut with wire clippers. The loose pieces of concrete were then dug out, leaving a clean hole through the floor approximately 30 in. in diameter. The total time per hole was about half an hour, counting the time to go through the concrete.

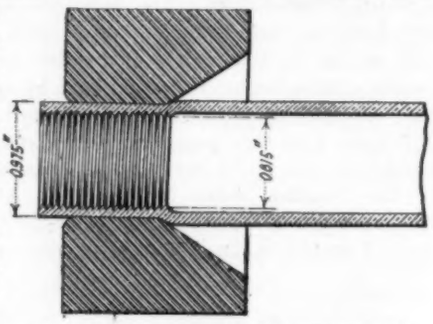
It was at first feared that dropping the skull-cracker on the concrete floor would result in shattering it over a wide area, but, peculiar as it may seem, the punching action of the falling weight was sufficiently intense to keep the breaking action entirely local, and no evidence of cracking was found between any of the holes, which were spaced approximately 15 ft. apart.

There are many such opportunities for making use of available factory equipment to greatly simplify the work and meet the daily problems of shop construction and operation if we will only look for them and see them.

Reclaiming Spoiled Work

BY CHARLES KUGLER

Not long ago I had the job of making a tool for reclaiming a lot of brass tubing that had been internally threaded with too large a tap. The tubes were 1 in. outside diameter, 0.815 in. inside diameter and 12 in. long. The tap used was 0.840 in. diameter, while one of 0.821 in. diameter should have been used in the first place.



Method of reducing diameter of tube ends

To correct the mistake and render the tubes usable, I made a tool-steel ring having a hole 0.975 in. diameter, and of the form shown in the sketch. The ends of the tubes were forced into the ring, closing them enough to reduce the inside diameter by about 0.025 in. The tubes were then retapped with a tap of the proper diameter and of the same pitch as the tap used before. Since the slight decrease in diameter did not render the tubes unserviceable for the purpose for which they were intended, the inspector put his O.K. on the job.

I think this "kink" will be useful to mechanics who must quickly find a way of overcoming such exasperating mistakes.

Put Full Information on the Drawings

BY R. B. WILLIS

Present-day drawings tell their story to much better advantage than drawings used to do, partly because there is less shading and fancy lettering on them.

The practice of giving each part a name as well as a number is becoming established, and this is a time saver for the outside shop that is bidding on the manufacture of parts. The name tells the estimator something about what the part has to do and its relation to other parts, so that he is enabled to see where a saving in cost may be effected without detriment to the job.

I have found it good business to tell the whole story, especially when sending out sketches of formed cutters. Figures mean exactly what they say when read by the maker of formed cutters, and many dollars may be saved by marking non-essential dimensions and shapes with the expression "ordinary care."

I know of a firm that sends out excellent drawings in most respects, but it has a bad habit of specifying

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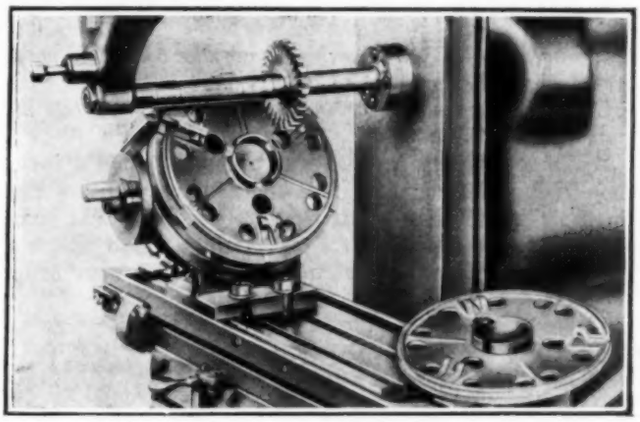
dowel pins ¼ in. in diameter and so long that the locating fit goes ⅝ in. deep. This is bad practice, since the pieces so located must be pried apart, often bending the projecting ends of the dowels and getting the holes out of shape. Pins that fit properly will locate the parts just as well if they enter but ⅛ of an inch.

In cases where machines have been built in an experimental department, the drawings should be checked by someone who is familiar with the working of the machine. This is because a draftsman who makes the drawings from an existing machine will try to get all dimensions exactly as they appear on the machine, without regard to the probable fact that the experimenter whittled out some of them so that they would "look about right." When a shop starts to make these parts to the accurate dimensions and radii as laid down on the average drawing, somebody will discover that they fit nothing but the atmosphere and could be made equally serviceable at much less cost.

Fixture for Milling Slots in Cover Plates

By John Cunningham

In the manufacture of a certain type of cover plate for automobile clutches, it is necessary to mill six slots, three in the hub and three between lugs near the periphery. While the inner and outer slots are in line, they the not of the same width, so that two operations are necessary. The fixture shown was built by the Kearney & Trecker Corporation, Milwaukee, Wis. It was designed for operation at an angle to prevent the cutter from cutting into the raised ring outside of the lugs.



Fixture for slotting automobile clutch-plate covers

For milling the outer slots, the work is located by a fork latch (not shown) that spans one pair of lugs. After the outer slots have been milled in a batch of covers, the cutter is changed and the inner slots are milled. For this operation the work is located to bring both sets of slots in line by the latch shown which enters one of the outer slots milled in the previous operation, and by setting the cutter centrally. Once set, the position of the cutter does not have to be changed during the operation.

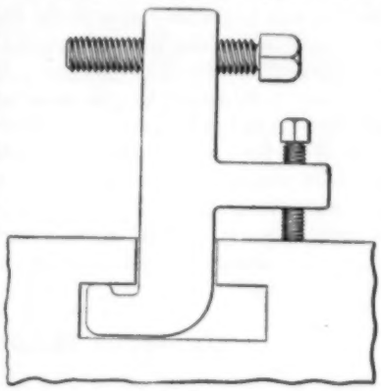
The hardened plate against which the work rests is reversible so that two sizes of cover plate can be accommodated by reversing it.

A Simple Planer Accessory—Discussion

By H. Beard

On page 854, Vol. 61, of the *American Machinist*, T. Heaton, in an article under the title given above, shows a screw post for use on a planer that he offers as an improvement on one described by F. J. Wilhelm on page 749, Vol. 60, of the same journal.

I herewith submit a sketch of a screw post that I believe is an improvement on both the posts referred to above. This post can be made by any blacksmith and can be adjusted to an angle to suit the set-up in which it is used.



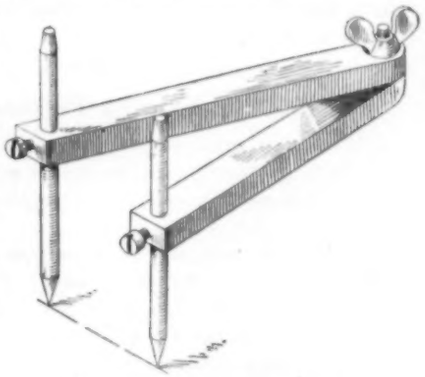
An adjustable screw post

If the corners of Mr. Heaton's screw post were rounded in the proper places, it could be hooked in and taken out of the T-slot without disturbing any part of the set-up, which is a distinct advantage, especially where duplicate pieces of work are set up in gangs.

A Spacing Center Punch

By S. E. Frew

A toolmaker often has occasion to make a considerable number of prick-punch impressions in a piece of work when it is of distinct advantage to have them equidistantly spaced, as in laying out a die to be drilled, and there are several "spacing prick-punches" on the market designed for the purpose. The sketch shows a device that can be made in a few minutes' time and requires only a couple of pieces of cold-rolled steel, an equal number of stubs of drill rod, several small standard screws and a wing nut. The workman can elaborate upon the design as much as circumstances (and the eagle eye of the boss) will permit.



A cheaply made spacing center-punch

The two pieces of cold rolled are each drilled at one end for the pivot screw. One hole should be tapped and the other made body size so that the screw will stay "put" and the wing nut will clamp the pieces tightly together. The other end of each piece is drilled and reamed transversely to fit the drill rod nicely.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Grinding Piston-Pin Holes

Q. Do you know any builder of grinding machines that makes a grinder especially for grinding piston-pin holes for oversized piston pins? The sizes to be covered are from 1¼ to 2 inches. If there is no special machine built for the purpose, do you know of any machine that could be used for such work?

A. The Bryant Chucking Grinder Co., has built one or more machines for grinding pin holes in pistons. If you have a Bryant grinder it is possible you could get the maker to build such attachments for your machine as would render it adaptable for the desired purpose.

Effects of Heavy Cuts

Q. Can you refer me to any literature giving an account of the effect produced on steel castings machined by a so-called "hogging" cut? I am under the impression that castings undergoing severe punishment in machining will have cracks or tears set up on the surface, which will open up in service where the castings are subjected to heavy stresses.

A. While we cannot refer you to any special literature covering the effect on steel castings when machined under a "hogging" cut, we believe some of the standard books on metallurgy touch in a general way on the effects on metals by altering the equilibrium of the structure and disturbing the existing tension. A "hogging" cut certainly disturbs the equilibrium of the structure and the surface tension, but to what extent such disturbances may be the cause of opening up or fracturing the metal in after use, we are not prepared to vouchsafe an opinion.

Melting Iron by Petroleum Gas

Q. Can you give me any information about melting iron by petroleum gas, or recommend any book that treats fully on the subject of melting iron by natural gas?

I have used gas direct from the well for some time with considerable success. The furnace consists of an old 400-liter drum with the top knocked out. The drum is lined with firebrick and bottomed with loam. The cover is removable and lined with firebrick. It is slightly domed and has a 4-in. hole at the top. The gas enters at the bottom of the furnace at 50 to 60 lb. pressure, so we do not require a blower.

While this arrangement is all right as far as it goes, I want to melt more iron than its capacity will allow, and shall have to build a cupola of about one-ton capacity. I am running a repair shop on the edge of the world and the nearest point of supplies is more than 1,000 miles away.

A. We regret to say we are not able to give you any information regarding the melting of iron by gas, either petroleum or natural, nor do we know of any book that will help you.

It would seem to us that in melting iron by a gas-fired cupola, something would have to be used to take the place of coke in keeping the iron up from the sand bed. Otherwise the flame would not have a chance to melt the iron thoroughly and the result would be cold iron, full of slag. However, as you appear to have had considerable experience, you have probably figured out some way to support the iron above the bed, during the melting.

Motor for Grinding Machine

Q. What horsepower motor will be required to drive a grinding machine having a wheel 14 in. in diameter? The work to be done is grinding the ends of magnet steel 2x3 in. in section. The amount of stock to be removed is ⅛ in. and the operation is to be continuous.

A. From your description of the work to be done and the size of the wheel, we believe a 15-hp. motor will be about right.

Plans for a Forge Shop

Q. I would like to get some plans for a modern forge shop to be used for instruction purposes. The shop will have about 20 forges. There will also be a lecture room containing a demonstration forge.

Can you furnish me with a set of plans or tell me where I can get them?

A. Unfortunately we have no plans for such a forge shop as you describe, and do not believe you can find them already prepared. It would seem to us that some of the concerns making forges would be glad to make you a set of plans, on the chance of getting your order for the equipment.

Making Steel Wool

Q. Can you give me any information regarding the manufacture of steel wool?

A. There are several processes of making steel wool. In one process we are familiar with, round wire is drawn over a long table and is shaved by eight or ten tools set in tandem in a frame or bridge above the table. The tools are similar to the bits used in wood planes and are set at about the same angle.

The grade of the wool is governed by the depth of the cut and the coarseness of the wheel on which the tools are ground. The grit of the wheel forms a number of points or teeth on the tools and each point takes a chip. The depth of cut should not be greater than the pitch of the teeth or points, otherwise the result would be a broad chip of unequal thickness, the thin parts being opposite the teeth in the tool. Strange as it may seem, the finer wool is made by tools ground on a coarse wheel, since such a wheel makes more cutting points on the tool.

Technical Abstracts

Industrial Research

The oldest experimental and research unit of the General Electric Co. is located at Lynn, Mass., and is known as the Thomson Research Laboratory. It was started there forty-two years ago and among its notable achievements may be mentioned electric welding, flame arcs, constant current transformers, integrating watt meters and others too numerous to detail.

There is still under the direction of Prof. Thomson a staff of about twenty men employed in research and development problems. These men are composed of physicists, chemists and mechanical and electrical engineers and men of similar accomplishments.

At Pittsfield the research department is working to improve the quality of the sheet steel used in transformers and the oil used for insulating purposes. It is interesting to note that in 1901 the General Electric Co. felt the necessity of adding to its already existing laboratories one devoted to the definite purpose of undertaking research in pure science. It is stated that the work of this laboratory has resulted in great development of the vacuum tubes, X-ray tubes, incandescent lamps, radio research and ferrous and non-ferrous alloy research accomplishments.

In the United States there are 500 industrial laboratories employing about 5,000 chemists and physicists. One of these also under control of the General Electric Co. has its own test track four miles long equipped with ample power for the operation of the heaviest locomotives at speeds up to 100 miles an hour, and on this track has been installed a new testing machine capable of measuring the vertical and lateral pressures exerted upon the track rails by each axle of locomotive or car at any speed.

Research work may seem at times far fetched to one employed on the outside, but an interesting example of the extent to which it becomes a creator of new devices is given, wherein one large electrical corporation employing 15,000 men is engaged almost exclusively in the manufacture of products that were the outcome of the research laboratory, and the value of its annual output is over $60,000,000.—*Journal of the Franklin Institute*, January, p. 65.

Can Ford Be Universally Imitated?

Engineer N. Stern, factory manager in Frankfort, Germany, begins a searching critique of Ford's book, "My Life and Work."

It appears that this work has had an almost intoxicating effect on the Germans. Many people, who ordinarily would never read a book of this kind have devoured Ford's publication and have considered it "gospel." The cause was, of course, everyone's desire for success—to learn how to get on—here taught by a man who himself had succeeded in a dazzling (to Europeans, almost unbelievable) manner.

The employers followed Ford ideas wholesale. Able engineers and superintendents were discharged because they did not show 100 per cent enthusiasm for complete "Fordization" of the enterprise. Sellers of raw material, however, also held Ford up to the purchasing agents as a new Moses: "To produce does not mean to buy cheaply and to sell dearly. It means to buy the raw materials at reasonable prices." (Translation from the German. The abstractor has not the English original before him.)

The workers, of course, hailed Ford as the apostle of high wages and adequate rewards for conscientious efforts put forth in behalf of their employers.

The German reviewer asks two questions that may be of general interest. First, does Ford really give the true inwardness of his achievement; aren't many of his enunciations afterthoughts, parts of a gradually developed attitude that may represent a good ideal, but did not form in times gone by the conscious motives of his actions; second, even if Ford's statements were all real announcements of fact, could his methods be generally imitated?

In answering both these questions the reviewer counsels extreme circumspection. To him Ford's success is a unique occurrence, a singular combination between a remarkable, most unusual personality and the conditions of the time and the country in which he lives. No man who is not a Ford, should attempt to imitate a Ford slavishly, and certainly it would be the height of folly to try unconditionally to "Fordize" Germany.

Ford's economical gospel is: "Cheapen your products by increased production and care nothing for competition." This cannot be generalized. Cheapening the price of a trouser button would not influence the sale of more trouser buttons in the least. Cheapening certain kinds of automobiles may be of little value, unless the price can be carried below a certain limit and sales methods perfected.

In America, as a German writer with some exaggeration says, any worker can acquire a Ford for one or two months' wages. In Europe there is hardly a car that does not demand the wages of a year. Evidently there is a gap there which some cheapening does not begin to fill. The European situation is different not only in degree, but in kind, and must be met in an entirely different way.

With all admiration for Ford's achievement, the author finds that there is just one thing that all can learn from Ford unreservedly, and that is the maximum possible use of brain power. But the results may be entirely different in Germany from what they were in America.

Germany has in the past made recognized contributions to the world's progress by application of science. The ZR-3, the Mercedes compressor engine, Flettner's cylinder sail, and many other things to mention the field of power propulsion only, demonstrate that genuine service may be rendered in this way, and genuine achievements may be attained.—*Der Motorwagen*, Dec. 10, p. 662.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Old Machine Equipment and Bankruptcy

A RECENT catalog of the machinery, stock and equipment of two old and well known metal-working shops in Connecticut, tells a sad story. Both concerns prospered in the days when both the management and the equipment were young and vigorous. But like too many institutions that succeeded when competition was not so keen and before the days of modern production methods, they failed to realize the changes that have occurred and clung to old machine equipment long after it should have gone into the cupola.

There were some fairly modern machines it is true, but home-made engine lathes of uncertain vintage, lathes and boring machines made by builders who have been out of business for a quarter century, planers dating back before the Civil War, tell the story of a handicap too great to be overcome. The small diameter of the line shaft alone shows that heavy cuts could not be taken.

Every shop manager should take the opportunity of pointing out examples of this kind to directors or bankers who hide the check book when new machine equipment is mentioned. Such cases emphasize the necessity for the most efficient equipment and point the fate of those who try to economize by getting along with machines that have outlived their usefulness as producers of dividends.

A list of antiquated machines offered for sale by the receivers of bankrupt concerns is the best evidence possible that modern equipment is not only advisable, but essential, in the making of dividends.

Buying Second-Hand Machines

MOST of the evils and annoyances connected with the sale of second-hand machines can be eliminated if the buyer will use the same precautions he does in buying new machinery. He should, of course, use even more. However, many buyers seem to take the seller's word without question when second-hand machines are concerned. The possibility of saving a few dollars frequently blinds a purchaser to obvious pitfalls.

There are perfectly legitimate fields for used machines in good condition—if they are bought at the right price. In too many cases, however, what seems to be a bargain is a bad buy when the cost of supplying missing parts and doing needed repairs is counted.

In several cases we know of, prospective purchasers of used machines have asked the builders to send a man to estimate on the cost of putting them in satisfactory condition. In some instances the estimates sold the machines while in others it was found to be cheaper to buy new ones.

Where the agent for a standard machine also sells used machines of the same make, he cannot be too careful in being sure that he sells only serviceable used machines. No matter if the customer does buy a machine "as is," he is not apt to buy a new machine of the same make unless the used machine proves satisfactory.

The real problem is to get buyers to be honest with themselves in buying used machines—and to make dealers see, and feel, that dishonesty, even in minor details, brings the same punishment here as elsewhere. The desire for a bargain often leads men to overlook glaring faults in used machines. The results are frequently costly rather than economical.

Investigating Engineering Education

THE Society for the Promotion of Engineering Education, under a grant by the Carnegie Corporation, is undertaking a thorough study of engineering education both in the United States and in other countries. The project is highly commendable.

Interest in higher education has taken a tremendous jump since the War. The result has been that the older, endowed universities in the East have had to limit their enrollments. At Princeton, for example, up to the first of the year there were over 1,900 applicants for admission with the class entering next fall. About 600 can be accommodated.

Coincident with the increasing desire for higher education has come the question as to the quality of the training offered. There is wide divergence of opinion among educators themselves as to what constitutes an adequate cultural education. Science is pitted against the classics, co-operative courses like that at Cincinnati against the conventional "straight" course, the advocates of athletics and other extra-curriculum activities against those who believe that classroom work is of paramount importance.

Engineering education has attracted its full share of criticism and it is therefore well that a society with the standing of the S.P.E.E. should endeavor to discover the "fundamental purposes and functions of the engineering colleges in the fields of education, industry, professional life and public service."

Shop Equipment News

Cleveland 1½-In. Multiple-Spindle Automatic Screw Machine

Designed to drive high-speed tools to the limit of their productive capacity, without the sacrifice of accuracy, a four-spindle automatic screw machine is announced by the Cleveland Automatic Machine Co., 2269 East 65th St., Cleveland, Ohio.

Centralized control, provision for chip accumulation, distribution of cooling lubricant, and lubrication of the machine itself have been made features from the standpoint of operation.

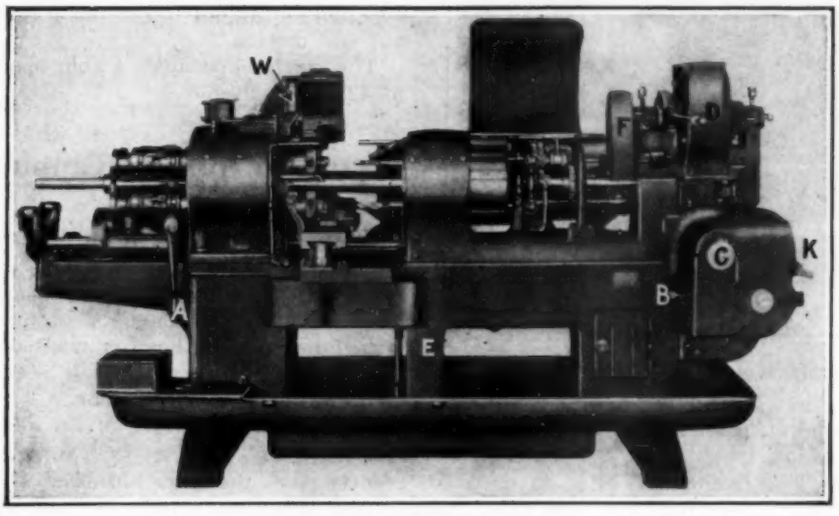


Fig. 1—Cleveland 1½-In. Multiple-Spindle Automatic Screw Machine

Referring to Fig. 1, lever *A* is for opening and closing the chucks by hand when desired, serving principally when stocking the machine. It is not engaged in the position shown and hangs down out of the way, but it is designed to swivel into position when desired for operating the chuck thimbles one at a time, as they are indexed into position.

Lever *B* controls the hand feed, shaft *C* provides for the attachment of a crank to turn the machine over by hand, and lever *D* throws the power drive in or out.

The problem of rapid chip accumulation is met by providing generous space in the bed above the chip pan, and to make the most of this space by installing deflectors in the center bed section *E* for even distribution.

Cooling lubricant is delivered to the cutting points through individual tubes whose construction is telescopic to keep the point of delivery at the cutting edges regardless of turret tool movement. The amount of lubricant can be regulated by individual valves. This arrangement in the case of the threading spindle, through which the lubricant flows, makes use of its position to wash chips away as well as to lubricate the chasers.

Machine lubrication is provided for by a reservoir on the top of and serving the work head; by another reservoir inside the frame under the power clutch from which oil is piped to the lower bearings; by glass sight-feed oil cups on the drive wheel shaft, and by individual spring-cap oil cups and compression grease cups at all other points.

A wide range of speeds and feeds has been considered advisable and therefore there are seven steps in spindle drive between 210 and 751 r.p.m., and ten steps in attendant feed changes.

Loose change gears, stored in the cabinet in the base and accessible through the door shown, are employed for the spindle speed changes. The gears in use are housed in their position at *F* on the end of the drive wheel shaft.

The tool feed is made a function of the spindle speed by gearing from the spindle drive. Power is transmitted vertically downward from the change speed gears by suitable gearing and a shaft to a worm and worm-wheel that, in turn, drive a pair of spur gears. Either one of this pair is made to mesh with the selective sliding gears, at *G*, Fig. 2, which are feather keyed to their shaft. These sliding gears are controlled and set by moving their lever *H*, thus making two speeds available to the driven shaft to which a nest of five spur gears *J* is secured.

Another shaft, which may be called the feed drive shaft is caused to rotate at various speeds with relation to the gear nest shaft by setting the gear shifter *K* to the desired position over the nest. The five available positions, combined with the two at *H*, make the total of ten feed speeds.

A ratchet wheel *L* is secured to the feed drive shaft, and just to the right of this ratchet is an independent assembly of pawls *M*

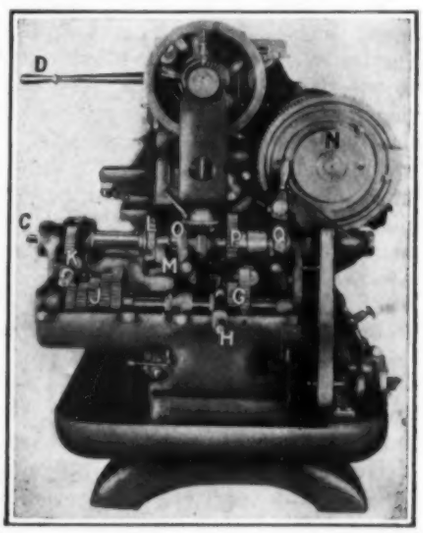


Fig. 2—Guard removed showing speed change gears and high speed indexing drive

SHOP EQUIPMENT NEWS

separately secured to the shaft. Between the two, the shaft is cut making, in reality, two shafts in line with each other, the left-hand section driving the right-hand part through the ratchet and pawls. The right-hand driven section terminates in a worm meshing with the worm-wheel *N* which is keyed to the camshaft.

The two-section shaft, ratchet and pawl construction is to make provision for periodically increasing the speed of the camshaft, without affecting the feed drive, for the purpose of indexing the work head and fon restoring this speed to normal, so feed can recommence, as soon as indexing is complete.

To obtain this high indexing speed, a high speed drive is taken vertically down from the drive wheel to the short shaft assembly containing the driving bevel gear *O*, the floating gear *P*, and the clutch *Q*.

This clutch is operated automatically by means of adjustable pins on the worm-wheel *N* or by hand, on occasion, using the lever shown. The gear *P* meshes with another gear secured directly back of it on the right-hand section of the feed drive shaft.

When *Q* is thrown in, *P* is caused to rotate and immediately the pawl or right-hand section of the feed drive shaft is increased to indexing speed. This carries the pawls, by centrifugal force, away from the ratchet and prevents any noise between them. When the indexing period is over, clutch *Q* is thrown out releasing the gear *P*. The pawls return toward center and again pick up the slower feed speed from the ratchet *L*.

The camshaft assembly is illustrated in Fig. 3, the rear view of the machine.

The movements of the tapping and reaming spindles which are independent of the main tool turret are controlled from drum *R*. Cams at *S* cause reversal of the tapping spindle rotation. Drum *T* controls the tool turret feed while *U* is for operating the two horizontal cross-slides.

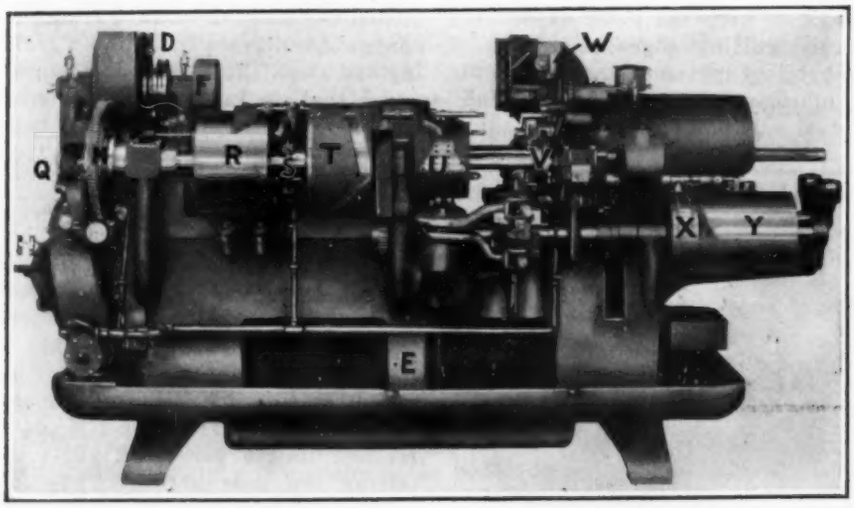


Fig. 3—The camshaft assembly mounted on the rear

The front cross-slide is used for rough forming and the rear slide for cutting off.

The cam at *V* transmits motion to a slide *W*, through a bell crank, to operate a vertical cross-slide which is mounted on the work head frame. The slide *W* contains a cam slot that engages this slide and controls its movement in either direction.

Between *T* and *U* a set of gears drive the lower section of the camshaft on which the chuck control cam *X* and the stock feed cam *Y* are mounted. Cam *X* moves the chuck thimble to open or release the jaws, in step with the motion of the work feed jaws which cam *Y* causes to move back along the stock and to then grip and feed it in against the work stop. A spider operates in connection with these movements to prevent short stock from working back.

There are a number of other points of importance such as the provision that has been made for converting the threading and the auxiliary reaming spindles for service in high-speed drilling by the addition of a bracket and gearing; the design to permit hand removal of the knurled steel guards to make a rapid chuck change; and the compression collars that are arranged on the spindles to compensate for variation in stock.

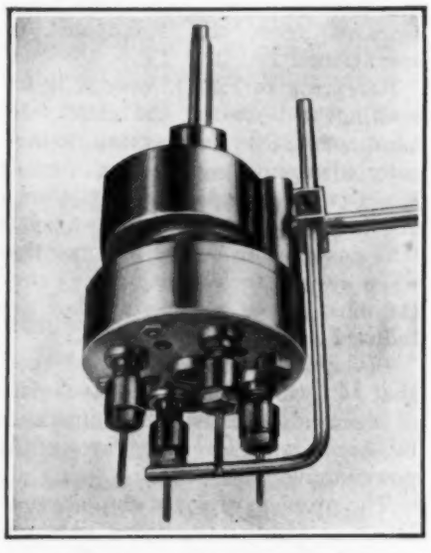
Maintenance has been taken into account in designing the spindle guards to exclude dirt and chips; in providing the removable steel collars and bronze rings in the spindle bearing construction; in arranging the provision for taking up wear in the front spindle bearings; and by including a means of take-up between the chuck operating thimbles and the spindle housing, to keep out end motion.

The machine occupies a floor space of 42x116 inches.

Errington Multiple Tapping Head

The Errington Mechanical Laboratory, Broadway & John St., New York, N. Y., has added a multiple tapping head to its line of drill press attachments. The head is adapted to use in connection with their standard Errington Reverse-Gear.

The principal feature of the adaptation lies in the fact that for close center work the direction of rotation of the drill press spindle is made left-hand for right-hand tapping. Thus, the idler gear for reverse rotation of



Errington Multiple Tapping Head

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the spindle is on the slow tapping side, while the quick reverse is on the direct side. This allows the gears in the attachment to be made larger and more servicable for production work than would otherwise be possible.

Brown & Sharpe Motor-in-the-Base Milling Machine

A motor-in-the-base type has been added by the Brown & Sharpe Manufacturing Co., Providence, R. I., to its standard line of milling machines. It is essentially a redesign of the column on the standard machine to accommodate the driving motor inside.

Provision for take-up on the chain drive, for convenient motor lubrication and access to the motor, for air circulation through the motor compartment, for access to the driving clutch adjustment, together with the arrangement of the cutting lubricant compartment in the base, around the foot of the elevating screw, are features in the design.

All sizes are fitted for a lubricant pump which is standard equipment on the No. 3-B plain machine. Belt drive can be furnished if desired and the motor compartment used for tool, part and cutter storage. Two styles are made of three sizes each, the 1-A, 2-A and 3-A universal and the 1-B, 2-B and 3-B plain.

With the side door open as in Fig. 1, the motor can be seen in place. Oil pipes to the bearings are run to this opening. An opening on the opposite side of the frame is covered with a ventilated plate similar to the door construction that, together with the protected openings in the removable plate in the rear, allows air to pass in or out on three sides of the motor.

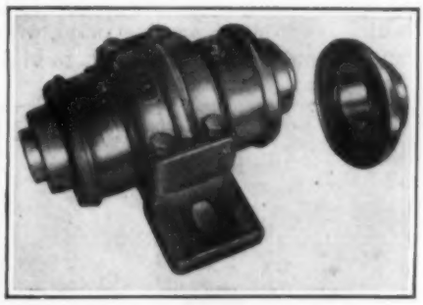
The motor is mounted on an adjustable base as illustrated in Fig. 2, which shows the rear of the machine with the chain guard and motor compartment cover removed. This base is hinged on one side and provided with an adjusting support on the other which can be set for the proper chain tension. The motor is machined to match the base and a gib holds it in place.

The clutch is mounted inside the driving pulley or sprocket and is accessible through an opening which is provided in the cast-iron chain guard when the latter is in place.

Fafnir Extra Dust Seal for Bearings

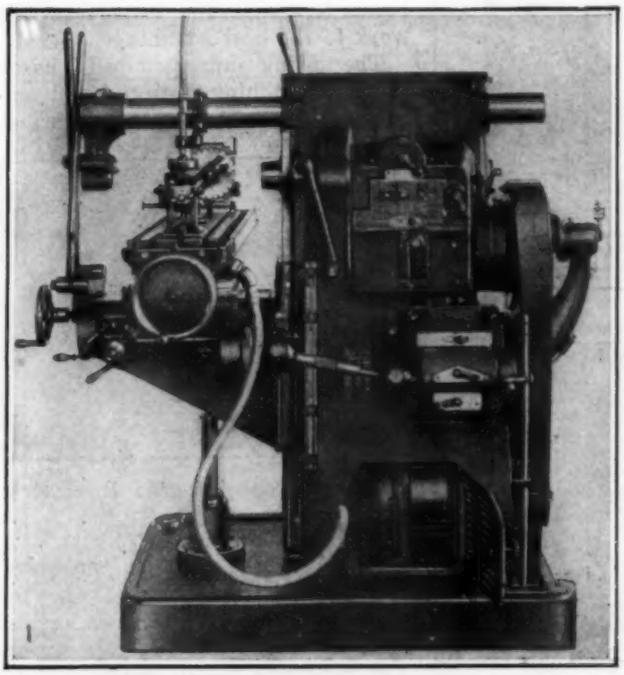
The Fafnir Bearing Co., New Britain, Conn., has designed an extra dust seal that may be applied to all sizes and types of Fafnir transmission equipment, either new or already in service.

The object of the seal is to provide security for bearings that are located in foundries, cement mills, abrasive plants, and similar locations where they are more than ordinarily exposed to dust, and where the dust is likely to be heavily charged with abrasive.



Fafnir Extra Dust Seal for Bearings

The bearing illustrated is equipped with a seal at each end. Another one of the seals, detached, is at the



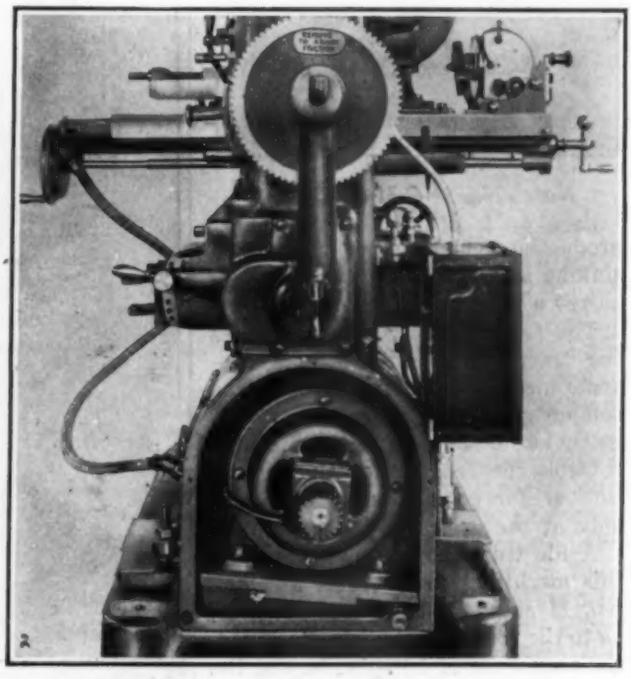


Fig. 1—Brown & Sharpe Motor-in-the-Base Milling Machine. Fig. 2—Guard and rear cover plate removed to show motor

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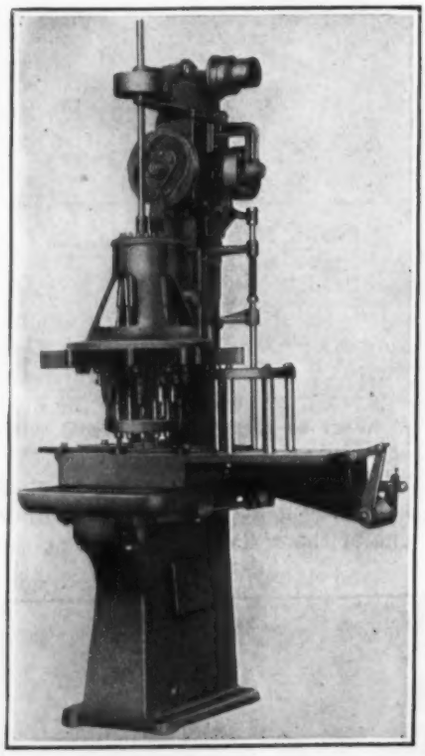
right. To apply them, they are slipped over the shaft, brought up to bear against the ends of the bearing housing and secured to the shaft, with which they revolve, by tightening a hollow-head setscrew.

Natco No. 11-C Automatic Multi-Driller

The National Automatic Tool Co., Richmond, Ind., has added to its line of multi-spindle drills a size No. 11-C which is equipped, as illustrated, with an automatic feed to adapt it to high



Natco No. 11-C Multi-Driller

production counterboring, countersinking and drilling on work that requires a light, quick-acting unit.

The feed assembly which actuates the track-plate feed-cam is a separate unit mounted on the top of the column as shown. A crank conveniently located at the front of the table controls the feed for continuous action or for completion of one cycle only at the desire of the operator.

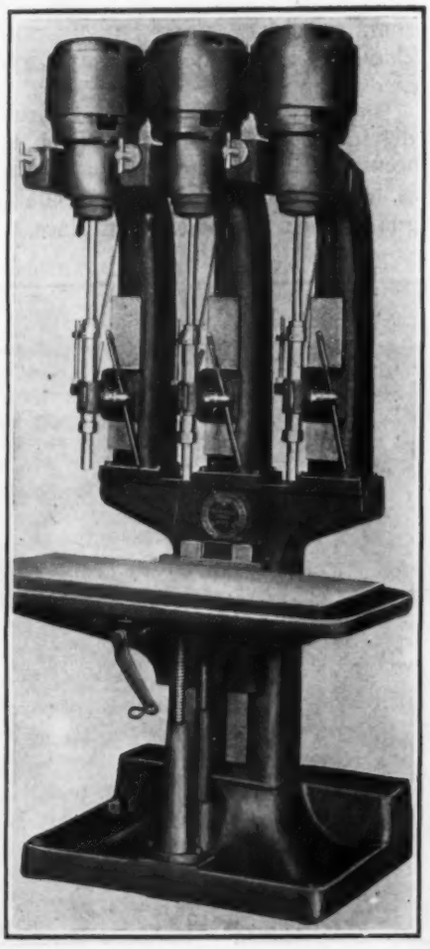
Aside from the automatic feature, this machine is comparable with the No. 11 standard hand-feed machine, as to the round- or straight-line head, the maximum of 16 spindles and the standard work table. Belt or motor drive is furnished to specification.

Leland-Gifford Motor-Spindle Ball-Bearing Sensitive Drilling Machine

The Leland-Gifford drilling machine illustrated has been designed and perfected by the Leland-Gifford Co., Worcester, Mass., and added to its line of ball-bearing drilling machinery.

A particular point of interest lies in the design of the spindle drive where, as illustrated, a motor is mounted vertically above each drill spindle which it drives direct.

Change of motor speed is available by operating a drum controller mounted at the side of each 220-volt, 3-phase, 60-cycle motor, and just below the main motor frame, for any one of four speeds which are 600, 900, 1,200, and 1,800 r.p.m. The rotor of the driving motor is of cast construction, and is mounted on a quill which is carried on ball bearings. There are no moving parts other than at the bearings in frictional contact.



Leland-Gifford Motor-Spindle, Ball-Bearing, Sensitive Drilling Machine

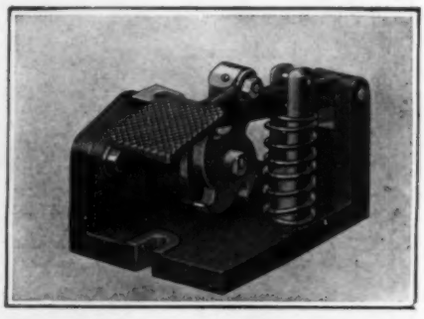
There is a liberal amount of adjustment provided for the table and the spindle. The latter is also provided with a depth stop that is adjustable.

The machines are made in 14-in. and 20-in. swing, and in spindle combinations of one, two, three, four and six. In their simplest form they are furnished with lever feed to the spindle but can be adapted for semi-automatic power feed. Back gears are then employed which doubles the number of available speeds and correspondingly increases the power at the spindle nose. Equipment for wet drilling can also be furnished.

"Logan" Foot-Actuated Pneumatic Valve

The Logansport Machine Co., Logansport, Ind., has designed the Logan pneumatic valve illustrated. It is being made for use in connection with the arbor press and other Logan air-operated equipment, but is available for the market to meet the general need for such a valve. Its use relieves both of the operator's hands to enable him to perform his work to the best advantage.

The spring supported pedal has a push finger hinged to it that engages recesses in a plate which is



"Logan" Foot-Actuated Pneumatic Valve

fastened to the stem of the valve. Depressing the pedal causes the plate to rotate the valve stem and open the ports, for a certain action. Releasing the pedal and again depressing it brings the valve to a setting corresponding to the initial one.

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Two-Spindle Vertical-Head Attachment for Milwaukee Milling Machine

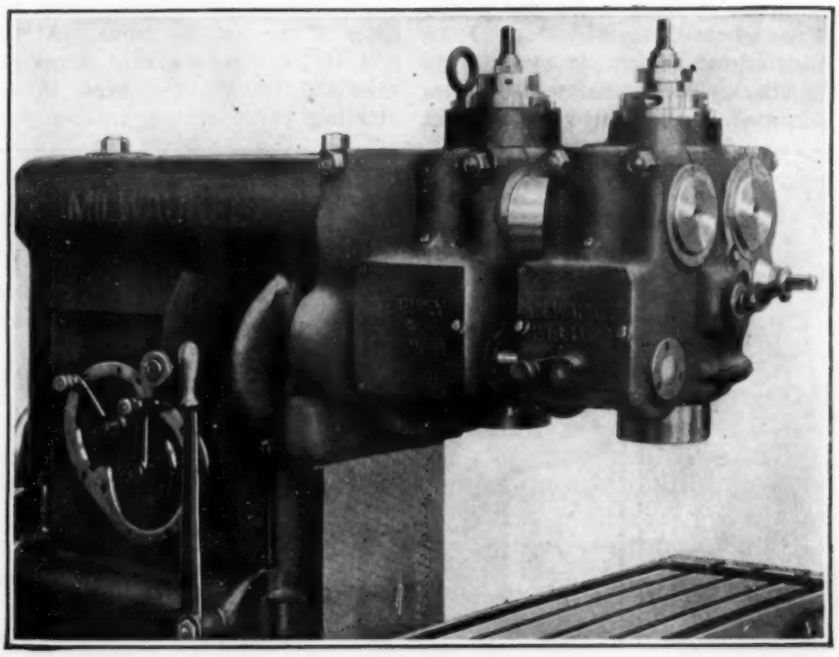
The Kearney & Trecker Corporation, Milwaukee, Wis., has designed an adjustable, two-spindle, vertical head for its Milwaukee milling machine and has put it on the market for all sizes in its line.

There are two independent heads, as illustrated, which slide on and can be clamped to the double overarms. The spindles stand central between the arms.

The inner head is secured to the machine column as well as to the arms and does not move. The outer head, however, is adjustable by means of a screw which is provided with a micrometer dial for accuracy of setting. The end of this screw is squared for a wrench and projects from the end of the outer housing. The spindle in the outer head can also be adjusted vertically.

Possible bad effect of tool drag when cutters of large diameter are in use is met by the addition of an eccentric bushing in each head between the housing and one of the overarms. By adjusting this bushing the heads may be tilted slightly out of vertical.

Direction of rotation of either spindle is optional as in addition to the reverse mechanism in the milling machine there is another in the outer head that can be used to reverse the outer spindle alone.



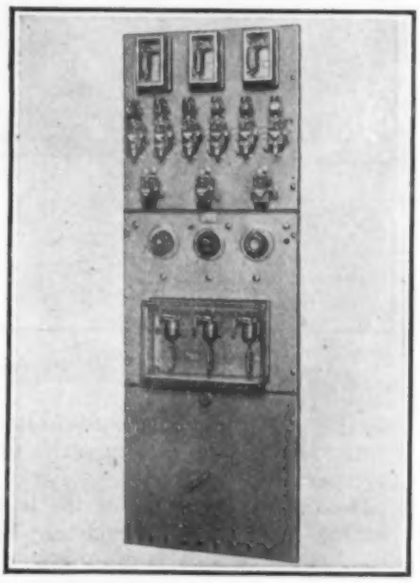
Milwaukee Two-Spindle, Vertical-Head, Milling-Machine Attachment

General Electric Three-Electrode Panel

The panel illustrated is offered by the General Electric Co., Schenectady, N. Y., as an addition to its line of electric melting furnace control equipment. It has been designed for use particularly with the smaller furnaces that are employed in making iron alloys, abrasives, carbides and similar products.

There are three balanced undervoltage relays at the top of the panel that each connect across the arc of one electrode to stop the automatic down-feed should the electrode come too close to the bath. Next below are six contactors, set in groups of two for each electrode. They control the raising, lowering and dynamic braking of the electrode movements.

In the middle section of the panel there are three calibrating control handles for the rheostats which are set at the rear, and a glass case containing three contact-making ammeter elements which are thus protected against dirt or tampering.



General Electric Three-Electrode Panel

They serve to automatically control the load on the furnace within a given range.

On the bottom section is the operating handle for the motor line switch which controls the d.c. circuit to the three electrode motors. The panel weighs approximately 700 lb. CR-4913-B2 is its designation.

In addition to the panel illustrated there is an operator's panel or push-button station known as number CR-4911-B2, that permits of change between hand- and automatic-control on one or more electrodes without interfering with the others.

This section weighs 130 lb. and brings the total weight of the equipment to 830 pounds.

Farrell-Cheek Portable Swing-Frame Grinder

The Farrell-Cheek Steel Foundry Co., Sandusky, Ohio, has designed and is marketing a portable swing-frame grinder that is intended primarily for use in steel foundries and billet mills.

A table-type base contains a swivel bearing in which the structural frame that supports the grinder can revolve through a complete circle. In the top of this frame an I-beam provides a track for a supporting truck that pin-suspends the grinder frame and allows the wheel to be moved longitudinally as well as to be swung up and down. The wheel is counterbalanced by the motor and

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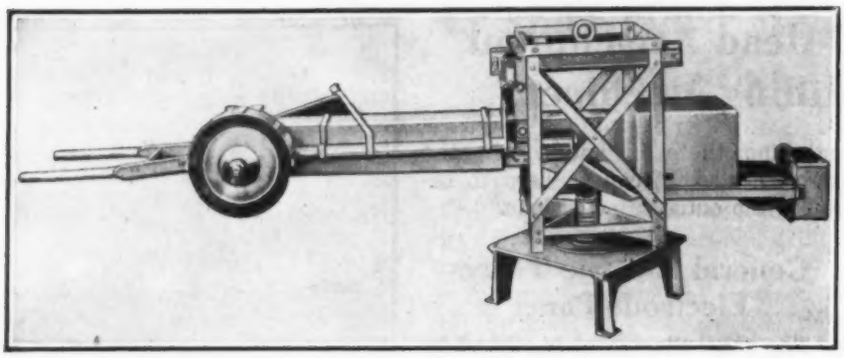

Farrell-Cheek Portable, Swing-Frame Grinder

starting equipment. Push-button control is located conveniently for the operator.

The driving motor is of the ball-bearing type and is completely inclosed, together with the starter and driving belt, to give protection from dust and grindings. Alemite lubrication has been adopted for all the parts that are in frictional contact.

Economy Bolt-Pointing and Threading Machine

The Economy Engineering Co., Willoughby, Ohio, has developed and is marketing the machine illustrated for automatically pointing and threading bolts that range in size from $\frac{3}{8}$x1 in., to $\frac{3}{4}$x6 inches.

The operator fills the hopper located above and to the left of the machine as illustrated in Fig. 1. A double-blade feeder, which is shown at the bottom of its stroke in Fig. 1, and at the top in Fig. 2, is automatically forced upward through the pile of bolts in the hopper and, on its way, gathers certain ones whose shanks fall between the blades. These are then suspended by their heads on the blade edges till, at the top of the stroke, the edges slant downwards to coincide with a chute reaching from the hopper to the working section of the machine. The bolts then move down into this chute by gravity and the blade feeder returns to the bottom of its stroke and repeats to keep the chute supplied.

On the side of the chute near the lower end, see Fig. 1, there is an escapement that, by operating two rods which alternately project into the path of the bolts, allows one bolt at a time to slide to the end of the chute where it is picked up by a transfer mechanism and carried to the chuck. This transfer mechanism is located, as illustrated in Fig. 2, at the lower end of the chute. It consists in a pair of cam-actuated spring fingers which grip the shank of the bolt and deliver it to the chuck jaws, where the fingers are opened and returned for the next bolt that has been released through the escapement. The chuck jaws are operated by a cam-actuated toggle arrangement illustrated in Fig. 2 at the left-hand end of the machine. While a bolt is being placed for threading, the turret is locked against rotation.

When the bolt is gripped in the jaws the turret is released and immediately indexed 120 deg. to come into position with the pointing head which is located, as illustrated in Fig. 1, in the upper center next to the lower end of the chute. This movement also brings the blank, that has just been pointed, into place for threading in the dies which can be seen in Fig. 1 below the pointing head. The completely threaded bolt is carried around at the same time to the loading station and dropped out as the chuck jaws are opened to take the next one from the feeder.

The pointing head and threading die are both fed forward by springs to reduce the possibility of jamming for any reason. Cams return them from the work. In the case of the threading die, there is a heavy spring for starting the thread that operates only for this part of the operation, when it comes against a stop and a light spring carries the head forward, overcoming only the drag of the moving parts. At the end of the stroke a cam opens the dies and returns the head to the starting point where another cam

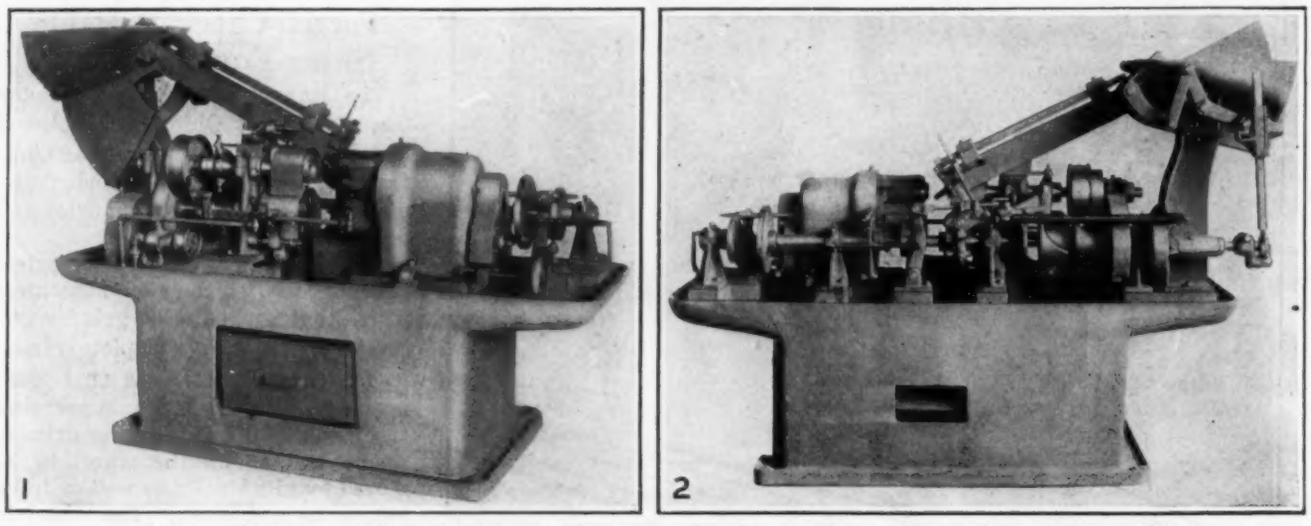

Fig. 1—Economy Bolt-Pointing and Threading Machine. Fig. 2—Rear view of the machine

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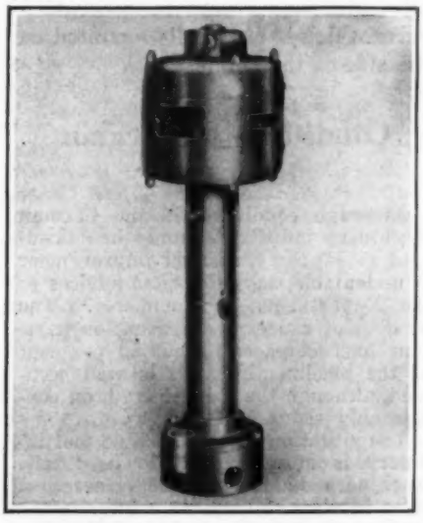
comes into action to close the dies, and then advances the head to position for the heavy spring to start the dies on the next bolt, as it is indexed into position.

Change gears are provided to get the best ratio between speeds and feeds for a given size of work. The cams are arranged so they can be replaced to suit varying lengths, and the turret head can be moved back after its clamps are loosened to accommodate the longer sizes.

A capacity on ⅞x1¼-in. U. S. standard bolts of 660 per hr. is claimed.

"Gusher" Motor-Driven Lubricant Pump

The Ruthman Machinery Co., Front and Pike St., Cincinnati, Ohio, has made improvement to its line of motor-driven lubricant pumps since they were originally described on p. 400, Vol. 61, of the *American Machinist*, and is offering a revised line,



"Gusher" Motor Driven Lubricant Pump

of which the model U-L-O, illustrated, is one.

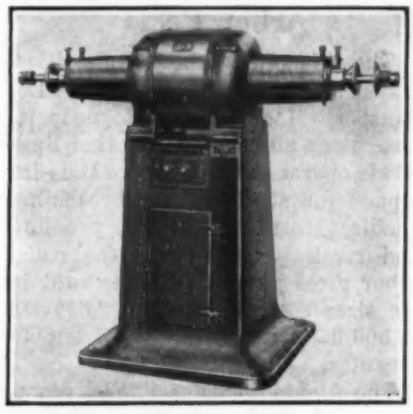
A 1,725 r.p.m., ¼-hp., vertical-type motor drives the ball-bearing impeller, which is constructed to pass grit, dirt or small chips without injury or clogging. The line is designed so there is a model for direct immersion in the oil reservoir and one for installation outside, below the liquid.

The sizes work against varying heads and deliver in varying amounts, that illustrated having a 12-gal. capacity at 3-ft. head and an 8-gal. capacity at a head of 9 feet.

Gardner No. 3 Heavy-Duty Ball-Bearing Polishing Lathe

The Gardner Machine Co., Beloit, Wis., has added a heavy-duty design of polishing lathe to its line of similar equipment and is offering it where the polishing service is to be particularly severe.

As illustrated, the motor end-housings have been extended to sup-



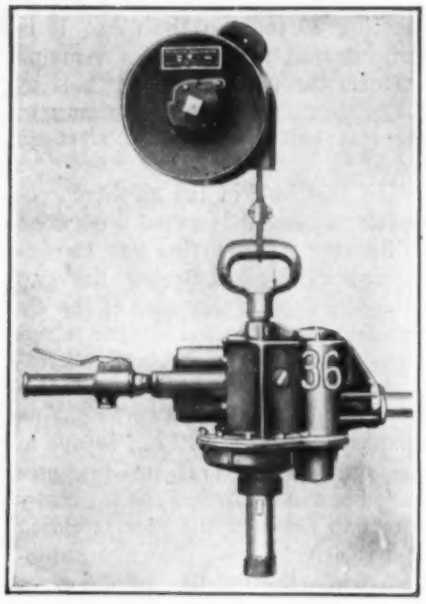
Gardner No. 3, Heavy-Duty, Ball-Bearing, Polishing Lathe

port the spindle as close as possible to the point of work-pressure application. The inclosed type motor, controlled with push buttons, located in the front of the base, and other general points of design, follow those originally laid out for the line. The spring-supported pin, located at the end of the housing, is useful in assisting to hold the spindle while tightening or loosening the wheel holding nuts.

Chicago Pneumatic Pedwyn Balancer

The Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y., is marketing the Pedwyn balancer for use in connection with portable electric and pneumatic tools as illustrated.

Two sizes are being manufactured, a No. 1, with a capacity range from 10 to 50 lb., and a No. 2, for 50 to 100 lb. Adjustment is provided for in the squared shaft ratchet, and dog, on the side of the balancer to make the lifting effort correct for intermediate points within their respective capacities. The machine is fastened to a permanent point over-



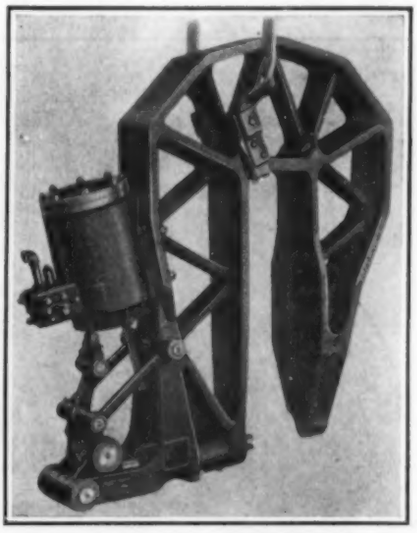
The Pedwyn Balancer

head or suspended from a trolley to permit greater flexibility in the use of the tool it is supporting.

Hanna Riveter for Gas Holder Fabrication

The Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., has recently placed on the market an addition to its line of riveting machines, developed especially for gas holder cups.

The frame of the riveter is of the "truss type," allowing for a 42-in. reach with a 12-in. gap. The cylinder has a diameter of 10½ in., and at a 100-lb. air pressure is capable of



Hanna Riveter for Gas Holder Fabrication

SHOP EQUIPMENT NEWS

exerting 30 tons on the dies. It is claimed that this pressure remains uniform throughout the last half of the piston stroke, corresponding to the last half inch of the rivet-die travel.

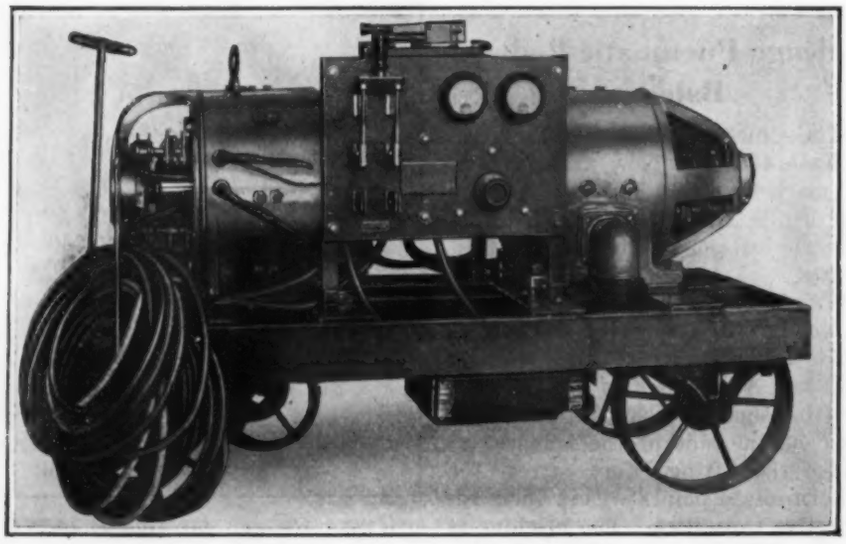
The first half of the stroke corresponds to very little actual work done on the rivet, this portion may be considered merely as closing the gap necessary for the clearance of the die and for the insertion of the rivet. This portion of the stroke is accomplished at an average leverage ratio from piston to die of two to one as compared with the ratio of twelve to one during the uniform pressure period of the stroke. Thus the clearance gap between the dies is closed at a relatively small power consumption, while the heading of the rivet is performed under fixed conditions, regardless of considerable variations in the length of the stroke and without die-screw adjustment.

Wilson Portable Arc-Welding Machines

The Wilson Welder & Metals Co., Inc., Wilson Bldg., Hoboken, N. J., is building two styles of portable arc-welding machines for production and repair use in foundries, steel mills, locomotive and car shops, boiler and tank shops and similar plants.

The unit illustrated is driven by a 10-hp. motor which is furnished on specification as to current characteristics, and is mounted on a truck and wired complete at the factory. It has a range of adjustment between 75 and 250 amp., and uses electrodes up to $\frac{1}{4}$ in. in diameter. The ball-bearing generator is self exciting.

The second unit is driven by a Le Roc four-cylinder, 15-hp., 1,500-r.p.m., gasoline engine. It has an adjustment range between 75 and 200 amp., and uses electrodes up to $\frac{5}{16}$ in. in diameter.



Wilson Portable Arc-Welding Machine

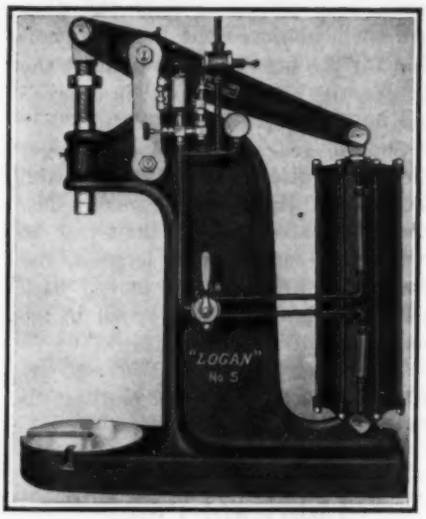
"Logan" Air-Operated Arbor Press

The "Logan" arbor press illustrated has been designed by the Logansport Machine Co., Logansport, Ind., as an addition to its other lines of air-operated equipment. It is intended for such work as broaching, bending, forming, forcing, pressing and riveting as well as for usual arbor press purposes, and is built in six sizes that range from 2,500- to 18,500-lb. capacity at 80-lb. supply pressure.

The design includes Shelby seamless steel tubing in the cylinder, electric cast steel for the lever arm, cup-packed piston and permanent cylinder to lever construction, a supply pressure-reducing valve and pressure gage, and an automatic lubricator in the air line.

Hand control is standard equipment but the "Logan" foot-actuated valve can be furnished to specification. Machines for capacities out of standard can also be built to specification.

The double-acting cylinder is pin-connected between the lever and the base and is piped to the operating valve with flexible connections. The ram is threaded and provided with a stop-nut to limit the stroke as may be desired. Air enters through the reducing valve, passes under the lubricator and enters the operating valve which is ordinarily mounted on the side of the frame.



"Logan" Air-Operated Arbor Press

Conditions in German Industries

Although conditions in the German machinery industry can not be considered satisfactory, a slight improvement is undeniable, says Consular advices to the Department of Commerce. The number of concerns operating on part-time has decreased; about 50 per cent of the machine industry is well occupied, although the staffs have been considerably reduced.

The situation in the machine tool industry is unsatisfactory. The textile machinery industry expects increased sales in view of livelier business in the textile industry. Business is dull in the agricultural machinery industry, as is to be expected at this time of the year.

As the Federal Railways are still refraining from placing new orders, the locomotive and wagon industry has as yet been unable to overcome existing difficulties, especially since private concerns are reluctant to place orders.

Centenary of English Railroad

The preliminary arrangements for the commemoration of the hundredth anniversary of the opening of the Stockton and Darlington Railway, England, have been completed. In view of the fact that the International Railway Congress will be held in London in July of this year, the celebration will take place in London during the first week in July, instead of in September which marks the actual anniversary.

News of the Week

Chicago Section of A. S. M. E. Will Hold Machine Tool Meeting

Plans for interesting sessions to be held on March 11

With the power meeting held in January, now a matter of history, the Chicago section of the American Society of Mechanical Engineers has turned its attention to another division of the mechanical field, that of machine tools and is now active in preparing a program more comprehensive than usual covering various phases of the machine tool field from the users standpoint. This is in response to repeated suggestions from the membership that more attention be given to the machine tool industry and it is the plan, if the initial attempt meets with the proper response, that the meeting will be made an annual affair for the section.

The meeting will be held on March 11, with afternoon and evening sessions, the former to be held at the rooms of the Western Society of Engineers and the evening meeting at the City Club.

The afternoon program is as follows: "Trend of Machine Tool Design," author to be announced; "What We Want in Machine Tools," by Robert R. Keith, superintendent, the Chicago Tractor Works of the International Harvester Co.; "Die Cast versus Machined Parts," by S. A. Hellings, vice-president of the Stewart Manufacturing Corporation, Chicago.

In the evening there will be a dinner meeting starting at 6:30 at the City Club, followed by a symposium on "Finishing of Plane Surfaces" which will be divided into two sections, one dealing with large surfaces and discussing heavy milling machines and planers and the other section on small surfaces dealing with light milling machines and disk grinders. In the first section heavy milling machines will be discussed by men of the Ingersoll Milling Machine Co., Rockford, Ill., and planers by Forrest E. Cardullo, chief engineer of the G. A. Gray Co., of Cincinnati. In the section dealing with small surfaces, light milling machines will be discussed by representatives of the Cincinnati Milling Machine Co., and disk grinders by F. E. Gardner, vice-president of the Gardner Machine Co., Beloit, Wis.

The response to the efforts of the program committee has been so favorable that a most interesting meeting is assured and a large attendance is anticipated and being planned by those in charge.

Engineering Foundation in Campaign for Larger Endowment

Lewis B. Stillwell succeeds Charles T. Rand as chairman

Increase of the endowment of the Engineering Foundation, through which scientific research work is carried on by the organized engineering profession of the country, was proposed at the annual meeting of its board held Feb. 18 in the Engineering Societies Building, New York City. Farley Osgood, president of the American Institute of Electrical Engineers, brought forward a proposal that the endowment be increased from the present sum of $550,000 to $20,000,000.

"If our country is to continue to progress," said the announcement, "the advance of the engineering profession cannot be slackened. If professional progress is to go on, the national societies must have the benefit of a sustained, considered, co-ordinated program of research."

It was announced that the four founder societies of civil, mining, mechanical and electrical engineers have united to present a plan whereby the desired endowment can be raised.

At the annual meeting of the foundation Lewis Buckley Stillwell, New York engineer, was elected chairman. He succeeds Charles F. Rand, who declined re-election after serving five years. Edward Dean Adams was elected first vice-chairman. Elmer A. Sperry, gyroscope inventor, was chosen second vice-chairman. Other officers elected were J. S. Langthorn, treasurer; Henry A. Lardner, assistant treasurer; Alfred D. Flinn, director and secretary.

The following were elected to the board as trustees of the United Engineering Society: George H. Pegram, American Society of Civil Engineers; J. Vipond Davies, American Institute of Mining and Metallurgical Engineers; W. F. M. Goss, American Society of Mechanical Engineers; and Bancroft Gherardi, American Institute of Electrical Engineers.

These eight members nominated by the governing bodies of the founder societies were chosen: Edward Dean Adams, Robert Ridgway, Arthur L. Walker, H. M. Boylston, Arthur M Greene, Jr., George A. Orrok, Dan Dunn, L. B. Stillwell.

Elmer A. Sperry, Charles F. Rand and Arthur D. Little were named members at large. W. L. Saunders, chairman of the Naval Consulting Board, will be a member ex officio as president of the United Engineering Society.

Eight S. A. E. Meetings This Year

Eight meetings of members of the Society of Automotive Engineers are planned for the new administrative year of the society, just begun. In addition to the general summer meeting in June and participation in the automotive maintenance equipment show and the national service convention, both to be held in the spring, there are to be meetings devoted to special subjects, including tractors, motor buses, motor railcars, taxicabs, fleet operation, production, service, aeronautics and motorboats and engines.

Mining Engineers Elect Reynders President

J. V. W. Reynders of New York was elected president of the American Institute of Mining and Metallurgical Engineers at the annual convention held at the Engineering Societies Building, 29 West 39th St., New York City. Mr. Reynders succeeds William Kelly and both the president-elect and the past-president were speakers at the banquet held on Wednesday evening, Feb. 18. The other speakers were Charles McCrea and W. L. Saunders, who acted as toastmaster. The dinner was followed by a dance.

The featured speaker of the three day meeting was Henry L. Doherty, operator of many public utilities, who outlined his plan for the conservation of oil. He stated that the present method of "grab" was wasteful and uneconomical and that much energy was lost in the excitement of drilling new wells.

Would Combat Bad Credits

Efforts are being put forth to arouse interest in the foundation of a fund to combat bad credit risks, according to an announcement recently received from the National Association of Credit Men. It is asserted that more than a quarter of a billion dollars is lost each year by bad debts, much of which could be saved through some sort of a concentrated effort. The association hopes to raise a million dollar fund toward the fight for better credit methods among business men.

Notes of Washington Activities

By Paul Wooton

Those who favor selective immigration and registration of aliens are planning a great drive toward those objectives. Since one of the necessary steps to the securing of such legislation is a more insistent public demand for it, the first work will be the further education of the people.

One of the essentials of such a program is the repeal of the contract labor law. This the American Federation of Labor favors, provided foreign recruiting of labor is precluded when the object is to bring in strike-breakers. The argument is that the United States is in a position to pick and choose. Instead of a nondescript crew, which forms the bulk of the quotas at present, it easily is possible for it to fill each quota with persons who will be an immediate, as well as a lasting, asset to the nation.

Instead of importing more men capable only of entering already overcrowded occupations, the employer could seek out a steady, high grade skilled man, reach an understanding and pay his way over. Not many men of this type will pick up, leave their families and come to America on the chance of being able to get a job.

A dearth of metal mine workers developed a few years ago. The places were filled with inferior foreigners. It happened at that very time that the exhaustion of the mines in Cornwell would have made it possible to recruit the 30,000 miners there had it been possible under the law. In the one case a lump was put in the melting pot which will give trouble for generations. In the other we could have brought in people who could help us develop our civilization, who know what government is and who hold our institution in high regard.

Alien Registration

If immigration is to be selective, it is contended further, there must be registration of aliens. This is held to be the only effective way of maintaining the barrier we have set up against indiscriminate entry of foreigners. Millions of persons are crossing and recrossing our land borders every year. This multitude cannot be forced through turnstiles for individual examination. We have long coast lines where aliens not entitled to entry can be landed almost at will.

If registration is required little vigilance at the borders and on the coasts will be necessary. Each alien would be required to keep his card ready for presentation if called upon by any authorized person, much as operators of motor vehicles are required to do. Such registration cannot be objected to legitimately, it is pointed out, as citizens frequently are required to undergo registration in some form or other.

While a wide demand already exists for a census of distribution to supplement the biennial census of manufactures, it is apparent that a higher head of public pressure must be created before Congress would consider seriously the large appropriation necessary. The cost is estimated at $1,000,000, but it is believed confidentially that such a census could be taken for less money.

Such a census of distribution is expected to receive the vigorous support of producers, as well as middlemen, and consumers, as accurate knowledge of the status of distribution would furnish additional light for the conduct of general business.

Attitude of States on Child Labor Law

The proposed twentieth amendment to the Constitution of the United States to give Congress power to limit, regulate, and prohibit the labor of persons under eighteen years of age has now been considered by the legislatures of a number of states with the following results:

Twenty-one States have refused to ratify by adverse votes in one or both Houses of the legislature. Connecticut, Delaware, Georgia, Idaho, Indiana, Kansas, Louisiana, Montana, Nevada, North Carolina, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Washington and Wyoming are the states.

The following states have ratified the amendment; Arizona, Arkansas, California and Wisconsin. (Arkansas by vote of 30 to 3 in the Senate of the present legislature has indicated its intention to withdraw the ratification of a previous legislature).

New Mexico in the House has returned a majority in favor of ratification.

The legislatures of Alabama, Kentucky, Maryland, Mississippi, and Virginia do not meet this year.

The other legislatures not mentioned above are yet in session or will soon meet.

The Amendment was rejected in a popular referendum in Massachusetts by a vote of almost three to one. The legislature of that State is yet to act.

A tabulation of the votes of the members of the State Legislatures which have already acted either favorably or unfavorably on the Amendment shows an almost identical ratio of opposition to the Amendment as that expressed by the people of Massachusetts, 809 for and 2,659 against or three against to one in favor.

Patent Office Report

Total receipts for the Patent Office amounted to $3,176,622 during the year 1924, according to a report made recently to Congress. It is also pointed out that the number of applications awaiting official action has been reduced by 12,000 during the year.

"THE CHAPERON"

The New York Evening Post

Germany's Attitude Toward France

The tariff in Alsace—French debts and taxes—Motor car saturation point—What the railways buy—Alien labor—The future of the franc

By Our Paris Correspondent

THE over-shadowing, hang-fire Franco-German agreement is the darkest spot in French economic affairs. It should have been consummated on Jan. 10, but only a temporary *modus vivendi*, covering a period of a few brief weeks, has been arrived at. In case the accord of the Versailles treaty affecting Franco-German commercial relations is abrogated and Germany avails herself of her rights to tax Alsace-Lorraine products on a high scale it will be a hard blow to French metallurgy, from raw material in the shape of iron ore to the most highly fabricated metal products in all lines.

Germany proposes tariff increases on French products running from 30 per cent to 70 per cent, which puts Lorraine mineral which may be shipped to Germany at just that much disadvantage as compared with their present status. Iron and steel manufactures from Lorraine and Alsace, heretofore entering Germany duty free, may not even benefit from the minimum tariff charges, all depending upon the reciprocal terms that Germany expects to get from France—or may not get, as the case may be—for her own exports to France and the French colonies.

Not only the Eastern departments, where this industry is so largely centered, are affected, but all French industry. The French machinery and tool trades may thus be influenced by the import of low tariff Germany-made competing products if minimum reciprocities are accepted, but on the other hand if they are not the French allied metal industries all along the line will find their German outlets curtailed and there will be a violent competition in world markets that up to present has only been suspicioned.

Better Exporting

Trade and traffic within the country is proceeding normally and in 1924, for the first time since before the war, French exports, in value in francs, have exceeded imports.

General taxes in 1924, in the amounts assessed and actually collected, exceeded 27 billion francs as compared with 25 billion francs in 1923 and 20 billion francs in 1922.

The famous and long expected "inventory of France" has at last been made public by the Minister of Finances. It shows a total interior debt of 660,320,000,000 francs, with assets (not including any expectations from the Dawes plan) of 599,500,000,000 francs. These are only the plain, tangible figures, omitting other items of inventory that while they may not be highly speculative as to assets (mines, forests, public buildings, etc.), are in part discounted by obligations such as the foreign war debts and other items that the government has taken on towards its own people, not actually due today in many cases, but likely to increase with coming years.

Individual incomes in France are totaled at 125,500,000,000 francs, which returned an income tax to the extent of 30,293,000,000 francs, virtually 24 per cent which of course includes the super taxes on higher incomes and does not affect those earning less than six thousand francs a year which figure, however, exempts only the lowest grade of labor.

The wage earner of the heavy industries, is still struggling against high living costs which show not the least sign of lowering.

Uncertain Future

General index figures again rose at the end of December to 518 for 45 general items, 523 for minerals and metals and to 722 for textiles. Minerals and metals thus registered a rise of 39 points since Oct. 31 last. This, as well as anything, shows the difficult business conditions, which may be put down to the uncertainties hovering over the future rather than to any inherent problems otherwise present. Industry and commerce are prosperous on the face of things, if not actually at the base. This at least keeps cash circulating and it is an apparent fact that most wage earners are today spending more of their incomes than in the days before the war.

Automobile production has virtually arrived at its limit. The home saturation point cannot be far off. The chief volume of business is now in the small 5, 6 and 7 hp. cars and small delivery vehicles on the same chassis. The Paris district has a potential production (including the Citröen and Renault plant for perhaps three-quarters of the output) of 400 cars a day. A British maker (Morris) has taken over the old French plant of Leon Bollée, one of the pioneers in the automobile business in France, and will manufacture here. The venture is regarded variously in view of French home market conditions that are decidedly depressed, but it may have some advantages over manufacturing in England from the point of view of labor, overhead and perhaps certain semi-raw material charges and this will be of an advantage in the export trade, the Morris being an important small car proposition in England. No American manufacture has apparently thought of doing this, at least has not done it.

French motor car exports are still increasing, averaging 3,500 cars a month in 1924 as compared with 2,500 in 1923. Great Britain, Germany, Belgium and Spain have been the largest buyers, the United States figuring for but 150 units. Imports were greatest in number from the United States, well above ten thousand cars, with Italy next with a thousand and Great Britain for 26 only.

The famous Mathis company at Strasbourg (before the war an avowedly German company making a popular small car) is increasing its output and has doubled its capital from five to ten million francs. Making only small (5 and 10 hp.) cars, the attitude of this company proves once again that the trend here is for the lightest of vehicles with the smallest possible efficient horse power, but of an efficiency far and above the cycle-car class.

Railways have been buying only the most necessary material and equipment. The P.L.M. has placed another $7,000,000 loan in America that will be used for equipment. The Eastern Railway is proceeding with the equipment of its Paris-Strasbourg express line with eight-coupled-driver locomotives, that are an innovation for Europe and said to be the heaviest locomotives in Europe. The Northern Railway has ordered 10,000 tons of 90-lb. rails for its Franco-Belgian line. Shop equipment is considered sufficient for necessary repairs and upkeep operations of power and rolling stock and few additions are being made in machinery equipment save as is called for by necessity.

New tariff classifications are being put into force on many items of iron and steel and other metal compositions and this may affect certain items hitherto bought in America. Largely, however, these refer to items of electric equipment and clock work and registering machines as well as prime movers of all classes from steam engines to internal combustion motors wherein they at all differ from classifications hitherto in use.

Alien Labor

Foreign labor is still being brought into France in large numbers for work in the mines and heavy industries. The native population of France has increased 425,000 since 1920, but during the same period the foreign population has increased 650,000, of which 250,000 have located in the Paris district which, all things considered, is now reckoned as the chief industrial section of the country.

The recent financial conference in Paris has tended to put a rather brighter aspect on money matters, but the truth is dollar and sterling exchange rates have shown no appreciable improvement since the Morgan $100,000,000 loan, and paper francs are proving an entirely unsatisfactory international circulating medium both from the French point of view and others who are obliged to accept them.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THE economic outlook seems paradoxical. Ever since November it has been assumed that the advance in the stock market presaged a revival in general business that would make its appearance when the boom in stocks subsided. Its end now seems to be approaching.

Action and reaction will of course continue. Some securities will go up and others will decline, but there are very few who expect that the all embracing movement toward a higher price level will continue.

The anticipated improvement in trade is therefore past due and it seems to be reflected in the bank clearings, which are well ahead of last year, as well as in the railroad traffic which is the largest on record at this season.

The sales of the mail order concerns and the chain stores are also heavier than they were in 1924, but the independent retailers and the department stores who handle about 82 per cent of goods sold at retail deny that their business is showing any marked increase and most of the jobbers say the same thing. This is especially true of the trade in cotton and woolen fabrics as well as of the business in hats and shoes.

Our domestic consumption of cotton since the beginning of the present season is still behind last year. The annual statement of the American Woolen Co. shows a loss of nearly $7,000,000 for last year and the Census has recently published some returns which show that fewer shoes and men's felt hats were produced in 1924 than in 1919, when the country's population was smaller.

There are many other things the demand for which was supposed to increase with the population that are in much the same case. But in almost every instance it will be found that the decrease in the actual or per capita consumption is explained by the changed habits of the people or the increased use of something else. Thus cotton and woolen goods have been partially supplanted by silk and furs. At an auction sale of furs held in New York last week more than $5,000,000 was realized and prices showed an advance of 20 per cent.

The lessened sales of hats and shoes is attributed to the automobile. The reduced demand for furniture is accounted for by the apartment that requires less furnishing than a house. Less meat is eaten than previously because the average dietary now includes more vegetables and fruit. We imported more than six billion bananas in 1924. This is about 60 bananas per capita. The legitimate liquor trade is gone but the consumption of sugar, candy and coffee has increased enormously.

It is said that there are 17,000,000 automobiles and as many radios in use. At a low estimate they probably represent an original investment of seven billions and an annual expenditure of at least a billion for upkeep. The increased earnings of the people account for part of this money, but much of it is diverted from the retail shops where it would otherwise be spent for unnecessary food and clothing. The savings bank deposits, the life insurance written and the assets of the building and loan associations are meantime increasing at a record rate.

Therefore it cannot be said that the people are thriftless or poor and the spotted and unsatisfactory conditions of which so many merchants and manufacturers complain seem to be due to a change in the popular taste and appetite rather than to a decrease in the buying power.

If this be true then the problem of the business man is one of readjustment rather than contraction for while there is no denying that most of the speculative markets are now in a reactionary mood it is equally plain that underlying conditions are sound.

Viewed in the light of the foregoing last week's developments are not in any respect discouraging. The decline in some stocks was severe, but it was overdue and was really healthy for everyone except the speculators whose bank accounts suffered. It is still easy to sell good investment securities and the demand for well secured bonds is apparently insatiable. The break in wheat was likewise timely and salutary.

New orders for steel have been less numerous, copper is back to 14½ cents and the other metals are also lower largely because of the prospective curtailment in the automobile output for 1925. The money market is easy, credit is in abundant supply and the weekly statement of the Federal Reserve System need not be commented upon as it shows no changes of importance.

The weakness in francs and French exchange is the only development in Europe that has attracted attention. It seems to connote the mistrust of French credit by the French people and if the latter commence to sell the *rentes* in which they have invested their savings foreign loans will be futile to stop the decline.

Perhaps it will be better to have it over with for it seems unlikely that any government will impose or can collect the taxes that must be paid if the French debt is to be met. But the issue will not much effect this country, however it may be decided and there is nothing in sight that seems likely to disturb the economic equanimity and prosperity of the United States.

What's Doing in Industry

Increased buying of machinery and machine tools by the railroads was reported last week in nearly all of the railroad centers, and some improvement was felt by dealers in New York, Chicago, Detroit and New England, Buffalo being the only center to report a dull market. Nearly all of the increase was due to the buying by the railroads with automotive buying also a feature in Michigan.

Manufacturers are watching carefully the progress of the automobile makers and it may be safely stated that the outlook for business in this field is brighter at the present than it was a year ago this month. Production probably will be on a more even keel this year than it has ever been before and this will be of material advantage to machine tool builders who will be able to plan their output along the same lines.

Exporting is getting attention these days, also, Japan, Russia, Germany and Italy being countries mentioned frequently, whereas a year ago Japanese buying was only in the rumor state, Russian buying was uncertain, there was no German buying, and Italy was not an important factor.

On a comparison basis February proves to be a trifle behind February of last year in most centers and about even with January of this year. However, it is pointed out that at this time last year the decline in sales was in sight, while this year inquiries point to a gradual and healthy increase in business.

Used tools are in a better demand than during the first two weeks of the month, but are not called for to the same extent as they were in January.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Chicago

Business conditions in the Chicago district are slowly improving. While actual orders are not coming forward as rapidly as hoped for, inquiries are being received which indicate that the time is approaching for a more active market.

Production in auxiliary lines, notably grinding machinery and ball bearings, is reported to be better by concerns specializing in these branches of manufacture.

The appearance of railroad budgets, which will enliven the trade situation materially, is expected from week to week, two of the leading Western roads being reported as almost ready to broadcast their requirements in the way of machine tools and special machinery.

There still continues a demand from automotive and radio production interests, the demand being chiefly for replacements.

Detroit

Market conditions in the machinery and machine tool field are slowly improving in the automotive centers of southeastern Michigan.

Detroit dealers state that more inquiries are being received, and that their scope indicates a general trend upward in all manufacturing lines.

Considerable electrical equipment is being ordered, while milling machines, lathes and standard equipment of various kinds appear in larger demand at present than at any other time since the first of the year.

Extensions are now under way in a large number of the motor car plants in and around Detroit. Of chief interest last week was the announcement that the Hudson Motor Car Co. had undertaken the construction of a three-story, reinforced concrete assembly building as an addition to its main plant on East Jefferson Ave. Changes in the Ford Motor Co. plants at Highland Park and River Rouge have not been entirely completed. The main assembly line was transferred from the Highland Park to the Rouge plant a few weeks ago, and since that time a general shifting of departments has been in progress at the Highland Park plant. This plant will not be abandoned, although it is held possible that the number of Ford employees working there may be materially decreased as further extensions, especially in the steel mills and foundries, are made at the Rouge.

For the first time in some weeks there has been a demand for used tools. As the automobile companies prepare for bigger production to meet the expected spring demand, local machinery men report a revival of purchase orders for road building machinery. Michigan's highway program for 1925 calls for the construction of several hundred miles of paved and otherwise improved highways.

Employment figures for Detroit—generally considered the most accurate index to industry's prosperity—show a slight increase.

New York

Improvement, especially from the railroads, was noticeable in the New York machinery and machine tool markets this week. The New York Central, the Lehigh Valley, the Central Railroad of New Jersey, the Missouri Pacific and the Lackawanna railroads were all in the market making the largest number of carriers to appear at one time in an Eastern market in some weeks. There are many large lists out for machine tools and closing will start on some of them within the near future.

The electric companies were also in the market with the General Electric and the Western Electric both purchasers. Railroad freight car makers and locomotive builders have been looking over machine tools also.

Much interest is being aroused in export trade. Improvement has been very marked during the past year and the future looks even brighter. Japan is about to inquire for machine tools, according to rumor, Russia is again buying single tools, Germany has representatives in New York buying special tools that are not made in that country, Italy and Greece are both developing into good customers, and Spain looms as a potential customer, according to exporters.

New England

Business for export was of considerable volume in the last week. One industry was given an order for twenty-five drop hammers, delivery of which will be made at points of shipment during the latter part of June. Builders of heavy labor-saving automatic machinery also report the receipt of orders for export business. Manufacturers of dies report a continuation of heavier European contracts and the general concensus is that European trade—especially in continental countries—is of good volume and is a substantial token of the recovery of European industries. The amount of business received for export is not confined to any particular New England section, but extends from Bridgeport to Worcester.

The sales curve in the domestic trade continues to point higher and the optimism of salesmanagers is increasing. The machinery salesmen, too, are experiencing better results on their trips. Some of the present buying is recognized as part of the deferred business, yet there is a sizeable amount of new business.

The improvement in sales is reflected in factory operations. In some sections the working schedules are being slightly extended, but it is principally in the recalling of mechanics out of employment. Mechanic labor is becoming scarce in such cities as Hartford and Bridgeport.

In Bridgeport the prospective expansion of the automobile industry is being closely watched by machine tool dealers.

Buffalo

Quiet still continues in the machinery and machine tool market in Buffalo. Despite this fact there is no tendency toward pessimism or disappointment. Fresh inquiries continue unabated according to the reports of most dealers and, while no large orders are reported to be in sight, many feel that there is bound to be considerable replacement business before the middle of the year.

One company reports real activity in its small tool department. Here again is a case of replacement and restocking. It is stated that one of the customers placed a large order for small tools for the first time in more than two years.

A casual investigation by some of the machinery people of Buffalo indicates that there is a large amount of obsolete machinery in use in some of the Buffalo industries. Heavy replacements are due. Whether they will really arrive this year remains to be seen. If general business is brisk and commodity buying is heavy it is likely that machinery replacements will be heavy for the owners of obsolete equipment will find that they will not be able to compete in price or delivery with manufacturers having up-to-date equipment.

In the electrical market, there is little call for hydro-electric equipment at the present time, but there is a considerable interest shown in individual drive equipment. Here, again, is shown the interest of industry in replacement with modern equipment.

Canada

Predictions of an improved outlook in the industrial fields of Canada are justified by the January figures of production that indicate a steady, gradual, though cautious expansion. A marked improvement is reported in the demand for machine tools, with every prospect of better business during the next few months. Foundries generally are buying freely. Warehouse dealers report January an excellent month, considerably in advance of the same month a year ago. Automobile plants are advancing production schedules.

The Oshawa, Ontario, plant of the General Motors Corporation is almost at capacity. The Baldwin Locomotive Co. has received orders from the Canadian National Railway for five passenger locomotives of the 6,000 type for duty on the railway's American lines. Twelve new street cars to cost $252,600 have been ordered from the Canadian Car & Foundry Co., by the British Columbia Electric Railway Co.

Cincinnati

Reports received from the machine tool plants in Cincinnati show that production during February has been rather spotty. A number of companies state that their sales have been fairly good, but there are others who have been forced to operate on a reduced scale. Most of the business that has been placed lately has been from the general industrial field rather than from any one industry. Railroads have been buying cautiously. While several roads have had fair sized lists out, they have been slow in closing them and railroad business as a whole has not been as good as had been anticipated. Automobile manufacturers also have failed to come into the local market to any marked extent.

Companies producing milling machines and lathes state that their business this month has been about on a level with that during January. Several good orders for planers have been received by Cincinnati concerns. Electrical tool manufacturers report that their sales have been fair in volume and they anticipate a slight improvement in the near future. Radial and upright drills have been selling fairly well, although the market for them is spotty. The used machinery market is in good shape with sales maintaining a satisfactory volume. Conveying machinery business is good at present.

Obituaries

ALBERT F. ROCKWELL, founder of the New Departure Manufacturing Co., Bristol, Conn., the Marlin-Rockwell Corporation, the Bristol Brass Co., and the Standard Steel & Bearings, Inc., died Monday, Feb. 16, at the New Britain General Hospital, New Britain, Conn. Shock of an operation for the amputation of a leg performed to stop the spread of septic poisoning caused his death.

DEXTER W. PARKER, president of the Charles Parker Co., Meriden, Conn., died recently at his home in that city. He was 75 years of age and a graduate of West Point Academy. He had been president of the company since 1902.

EDWARD WILLIAMS, head of the firm of Edward Williams, Smethwick, Birmingham, died on Jan. 30. In addition to the manufacture of cycles, chain wheels, etc., the firm has long manufactured special guards for machine tools. Mr. Williams was also director of H. W. Ward & Co., Ltd., machine tool makers, Birmingham, of the Stourbridge Rolling Mills, Ltd., and W. Canning & Co., Ltd., Birmingham, manufacturers of special electro-plating plant. During the war he was honorary general manager of one of the British national shell factories.

BENJAMIN F. ESGER, president and general manager of the Michigan Drop Forge Co., Pontiac, Mich., died recently.

ALFRED W. FUSSEY, president of the Peninsular Brass Works, and formerly head of the Detroit Brass Works, died recently at his home in Detroit.

Personals

HOWARD S. HART has been re-elected chairman of the board of directors of the Fafnir Bearing Co., New Britain, Conn. All other officers were also re-elected.

H. B. KRAUT, formerly with Joseph T. Ryerson & Son, Chicago, has been elected vice-president and general manager of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

LEONARD BARTLETT, formerly a mechanical engineer with the Metal Saw & Machinery Co., Springfield, Mass., has accepted a position with the Westinghouse Electric & Manufacturing Co., East Springfield, Mass.

H. B. HEIN, formerly with the Roy G. Hart Co., Chicago, has joined the Federal Machinery Co. staff with headquarters in Chicago.

HOWARD S. HART, chairman of the board of directors of Hart & Cooley, New Britain, Conn., was re-elected at the recent meeting of stockholders.

R. D. PERRY, president and general manager of the Perry-Fay Co., Elyria, Ohio, has retired, being succeeded by his son, R. D. PERRY, JR., as general manager, and by E. F. ALLEN as president.

C. H. VAN PELT has been made sales and advertising manager of the Cincinnati Ball Crank Co., Cincinnati, Ohio, succeeding V. A. DAVISON who has joined the General Motors Export Co.

HENRY W. STANDART has been elected president and treasurer of the Northern Engineering Works, Detroit.

H. H. SHELTON, formerly special regional representative of the Chevrolet Motor Co., has joined the organization of Durant Motors, Inc., as special representative of the vice-president's office, with headquarters at 1819 Broadway, New York.

N. M. SALKOVER, who formerly conducted the Metallurgical Service Co., Cincinnati, has combined his business with that of the Queen City Steel Treating Co.

A. J. BANTA has been appointed assistant general manager of the General Motors Truck Co., Detroit. Mr. Banta will have complete charge of engineering, manufacturing and purchasing.

SIR ALEXANDER RICHARDSON has resigned his position as editor of *Engineering*, London, and also as managing director of the publishing company. ROBERT HODSON PARSONS has also resigned as assistant editor of the magazine. MAJOR P. J. COWAN and HERBERT HENRY JOHNSON have been appointed joint editors succeeding Messrs. Richardson and Parsons. Mr. Richardson will become a consulting editor for several technical journals dealing with shipbuilding.

R. A. WILLIAMSON, general manager of the Oberlin Machinery Co., Oberlin, Ohio, has purchased control of the Parker Arbor Co., Ann Arbor, Mich., and the plant has been moved to Oberlin.

E. ALLEN MOORE, chairman of the board of directors, and ERNEST W. CHRIST, secretary of the Stanley Works, New Britain, Conn., sailed Feb. 21 for Europe. They will visit branch factories in England and on the Continent.

EDWIN H. PIERCE, superintendent at the American Steel & Wire Co. plant at New Haven, Conn., has been transferred to the Worcester plant as superintendent. MALCOLM W. REED succeeds Mr. Pierce at New Haven.

W. B. DANLEY has been made president of the Roto Co., Hartford, Conn., succeeding the late J. D. CHERRY.

T. A. RUSSELL, the Russell Motor Car Co., Canada, has been elected a director of the Massey-Harris Co., Ltd., to succeed the late SIR EDMUND WALKER.

MARSHALL POST, formerly manager of the American Steel Foundries, Sharon, Pa., has been appointed general manager of the Birdsboro Foundry & Machine Co., Birdsboro, Pa.

W. R. QUINN, formerly manager of the fuel oil department of the Combustion Engineering Corporation, New York City, has been appointed Pacific Coast agent for the same company. His headquarters will be in San Francisco and his territory will include Washington, Oregon and California.

Business Items

The John Inglis Co., Ltd., Toronto, has announced the formation of a subsidiary company, the S. Morgan-Smith-Inglis Co., Ltd., to manufacture and sell in Canada the Smith hydraulic turbines. The new company will have its headuarters at the John Inglis plant in Toronto.

Stockholders of the Stanley Works of New Britain, Conn., voted Feb. 14 to increase the company's capitalization from $6,500,000 to $10,400,000 by stock dividend and to retire 25 per cent of outstanding preferred stock amounting to about $1,800,000. Directors voted an extra dividend of 37½ cents a share on the old stock. They also voted 2½ per cent payable April 1, thus putting the stock on the new capitalization basis at the rate of 10 per cent, the same as before the increase.

Haves & Colt, the Leader Building, Cleveland, Ohio, will represent the Lancaster Steel Products Corporation in the state of Ohio and in the city of Buffalo.

The correct address of the branch office in Mexico of the Chicago Pneumatic Tool Co., New York City, is 1a San Juan De Letran, 15 Mexico, D.F.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Automobile tools. Bordeaux, France. Purchase. Reference No. 13,706.

Files and screws. Bombay, India. Agency. Reference No. 13,685.

Traveling electric cranes, 15 tons. Melbourne, Australia. Purchase. Reference No. 13,670.

Double-cylinder, centrifugal pumps and parts. Alexandria, Egypt. Agency. Reference No. 13,641.

Pumps, steam-shovel excavators, concrete mixers, conveyors and pile drivers. Weltevreden, Java. Purchase. Reference No. 13,645.

Trade Catalogs

Lathes. The South Bend Lathe Works, 435 E. Madison St., South Bend, Ind. "How to Run a Lathe" is the title of this booklet in which is found much excellent information regarding the many duties of lathes. Sectional drawings, halftone cuts, diagrams, tables of dimensions and data are combined to make this a useful hand book.

Drop Control Systems. The General Electric Co., Schenectady, N. Y. The voltage drop control system that is being marketed by this company is described in a twelve-page pamphlet that is perforated on the left side for filing. What it is, what it does, what it is used for, and why it is used, are explained as well as the construction of the machine.

Gear Teeth. The Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill. A small "mailer" has been prepared by this company in which is briefly described the spur gears made by the company. The accuracy of the teeth and the advantages of using them are both stressed.

Pyrometers. The Brown Instrument Co., Philadelphia, Pa. A booklet entitled "What's Under the Hood of Brown Pyrometers," has been issued by the company in which is described the parts used in the making of the pyrometers and the care exercised in the assembling. The booklet is illustrated.

Sand-Blasting. The Pangborn Corporation, Hagerstown, Md. The use of the sand-blasting machine for special work is told in this eight-page bulletin. The improvements in this machine are shown whereby dust guards surround the machine itself preventing the promiscuous distribution of dust particles.

Chrome-Iron Alloy. The Driver-Harris Co., Harrison, N. J. The product of this company, "Cimet," is described in a booklet perforated on the left side for filing. The corrosion, oxidation and abrasion resistant qualities of the alloy are stressed and there is contained a list of the uses to which "Cimet" may be put.

Electric Hoists. The American Engineering Co., Philadelphia, Pa. It is claimed in this catalog that the "Lo-Hed" electric hoist operates in the minimum headroom and many illustrations are found where headroom is extremely limited. The illustrations are designed to show the many different uses that have been made of the hoist and the diversity of industries using it.

Drill Heads. The Sellew Machine Tool Co., Pawtucket, R. I. A leaflet with fifteen illustrations effectively shows the various drill heads made by the company. There is but little descriptive matter, the pictures being used to tell the story.

Ball Bearings. The New Departure Manufacturing Co., Bristol, Conn. The latest price sheets have been issued by the engineering department of the company and are being mailed out to manufacturers. The new sheets are designed to take the place of others previously sent out and instructions for filing are sent with each set.

Milling Machines. The Kearney & Trecker Corporation. Milwaukee, Wis. Layout No. 11 has been recently mailed out. This is one of a series of layout sheets in which different milling machine operations are explained and illustrated.

Recording and Indicating Instruments. The Uehling Instrument Co., 473 Getty Ave., Paterson, N. J. The Apex CO_2 recorder made by this company is described and illustrated in a four-page folder that has been perforated on the left side for filing. Accuracy, economy and simplicity are emphasized.

Hack Saws and Blades. Clemson Bros., Inc., Middletown, N. Y. A booklet showing the different advertisements used by the company and the dealer helps that it sends out has been issued. It is entitle "Here's How We Help You Sell."

Oil Purification System. S. F. Bowser & Co., Fort Wayne, Ind. Power plants in various parts of the United States that have installed the "By-Pass-Batch" system of oil purification are shown by illustration and descriptive text tells the advantages that have been found by each. Among the plants shown are the Ford plants at River Rouge, Highland Park, Hegewich, Kearney and Ford City, Kan., many public utility plants and others.

Industrial Furnaces. The Chicago Flexible Shaft Co., 5,600 Roosevelt Road, Chicago. The Stewart furnace is described in this folder and a few of the 150 styles and sizes are shown by illustration. Spare parts for the products are also illustrated and manufacturers are told the advantages of having a stock of them on hand.

Roller Bearings. The American Roller Bearing Co., Pittsburgh, Pa. Installation sketches, load capacity and roller bearing equipped machinery are shown in this catalog. Much valuable data are continued as well as instructive sectional drawings.

Pamphlets Received

The Motor's Part in Transportation. By Roy D. Chapin, vice-president of the National Automobile Chamber of Commerce. Reprinted from *The Annals* of the Academy of Political and Social Science, Philadelphia, Pa. A comprehensive survey of the work that has been done in developing transportation through the uses of motors has been treated by Mr. Chapin. Comparison of automobile production figures and other subjects are discussed.

Production Hardening of Taps. The Automatic & Electric Furnaces, Ltd., 173-175 Farrington Road, London, E.C. 1. This is a heat treatment bulletin in which the production hardening of taps is discussed.

The Mechanism for the Graphitization of White Cast Iron and its Application to the Malleabilization Process. By Anson Hayes and W. J. Diederichs. Published by the Iowa State College of Agricultural and Mechanic Arts, Ames, Iowa. The results of an investigation conducted by the Iowa engineering experiment station are chronicled in this bulletin.

Executive Uses of Costs. The National Association of Cost Accountants, Bush Terminal Building, 130 W. 42nd St., New York City. This is one of the official publications of the association. It was prepared by Howard Berry, the comptroller for the Mathieson Alkali Works, New York City, and is subdivided into the following divisions: "Information Foremen and Superintendents Should Have," "Information the Work Manager Should Have," "Information the Director of Sales Should Have," "Information the President Should Have," and "Information the Board of Directors Should Have."

Some Points about Monopolistic State Insurance of Workmen's Compensation. Workmen's Compensation Publicity Bureau, 80 Maiden Lane, New York City. This paper is divided into two parts; first, "Some Points Against Monopolistic State Insurance," and second, "Some Arguments for Monopolistic State Insurance Answered."

Design of Specimens for Short-Time "Fatigue" Tests. By L. B. Tuckerman and C. B. Aitchison of the Bureau of Standards. Published by the Government Printing Office, Washington, D. C. Price, 5 cents. This is Technologic Paper No. 275 and discusses the controlling factors in the design of short-time "fatigue" test specimens, which differ from those of the endurance-run type of fatigue test.

Elimination of Waste. The Government Printing Office, Washington, D. C. Simplified practice, what it is and what it offers, is discussed in this bulletin. There is also contained a summary of activities of the division of simplified practice and a description of the services offered to American industries.

Engineering Achievements. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Special publication No. 1717 has been mailed out by this company. Many of the steps in progress that have happened during the past year are interestingly chronicled and the direct or indirect connection of the Westinghouse products are mentioned. The booklet has been prepared by H. W. Cope, assistant director of engineering at the plant and is dedicated to the late Benjamin Garver Lamme.

Calendar of Local Meetings

American Society of Mechanical Engineers

Cleveland, March 2. Under the auspices of the Cleveland Engineering Standards Committee. Presentation of approved American Standards to Cleveland manufacturers. C. D. Zimmerman, secretary, Cleveland Electric Illuminating Co., 70th St. station, Cleveland, Ohio.

New York, March 3. Joint meeting with the Heating and Ventilating Engineers. Oil-burning heating plants in office and mercantile buildings. Fred J. Bechert, secretary, 350 Madison Avenue, New York City.

National Association of Cost Accountants

New York, March 10. "The Relation of Cost Accounting to Foremen Training and Labor Problems."

Worcester, Mass., March 12. "The Use of Ratios in Cost Accounting."

Chicago, March 12. "Cost Finding for Different Types of Business."

Philadelphia, March 13. "Credit and Factors in Extending the Same—Character, Capacity, Cash and Collateral," J. H. Tregoe, secretary of the National Association of Credit Men.

Cleveland, March 18. "Financing as a Burden."

Rochester, March 18. "The Future of Motion Study in Industry," V. M. Palmer, the Eastman Kodak Co. "Methods Used in Tying up Factory Accounting with General Accounting," C. J. VanNell, the Eastman Kodak Co.

Buffalo, March 19. "The Cost of Government," and "The Manufacturing Budget."

Forthcoming Meetings

Southern Supply & Machinery Dealers' Association and the American Supply & Machinery Manufacturers Association. Joint Convention. The Atlanta-Biltmore Hotel, Atlanta, Ga., May 5, 6 and 7. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

The Society of Industrial Engineers. National Convention. Hotel Winton, Cleveland, Ohio, May 6, 7 and 8. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago, Ill.

American Gear Manufacturers' Association. Ninth annual convention, May 6, 7, 8 and 9. The William Penn Hotel, Pittsburgh, Pa. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19 C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig iron market retains its firmness; most of the price changes of the week were in an upward direction. Scrap is about 50c. per ton lower than a week ago. Tin plates and ship plates are two of the most active items in current steel buying. Demand is a trifle slower for semi-finished and strip steel. Bars are selling at $2@$2.10 per 100 lb., f.o.b., Pittsburgh mill; quotations as high as 2.20, however, are frequently heard. Structurals are $2@$2.20 per 100 lb., same as a week ago.

Non-Ferrous Metals—Most of the metals in this class are a trifle below the market as of Feb. 13. Demand is improving in copper, lead and tin.

(All prices as of Feb. 20)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$26.05
Northern Basie	23.77
Southern Ohio No. 2	23.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.25
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.76
Virginia No. 2	30.17
Basic	24.76
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.70@2.80	3.89	3.45	3.80
No. 12	2.80@2.90	3.94	3.50	3.85
No. 14	2.90@3.00	3.99	3.55	3.95
No. 16	3.10@3.20	4.09	3.65	4.15
Black				
Nos. 17 and 21	3.35@3.55	4.55	4.15	4.30
Nos. 22 and 24	3.40@3.60	4.60	4.20	4.35
Nos. 25 and 26	3.45@3.65	4.65	4.25	4.40
No. 28	3.50@3.70	4.75	4.35	4.50
Galvanized				
Nos. 10 and 11	3.75@3.85	4.75	....	4.50
Nos. 12 and 14	3.85@3.95	4.85	....	4.60
Nos. 16	4.00@4.10	5.00	....	....
Nos. 17 and 21	4.15@4.25	5.15	....	4.90
Nos. 22 and 24	4.30@4.40	5.30	3.00	5.05
No. 26	4.45@4.55	5.45	4.15	5.20
No. 28	4.75@4.85	5.75	5.45	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	¾	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	4.35	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.42½	3.10
Bar iron (3.00@3.10 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. Chicago, 3/32, 8.85c.; 5/32, 7½c.; ⅛, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.12½
Tin, 5-ton lots, New York			57.75
Lead (up to carlots), St. Louis	9.00	New York	9.62½
Zinc (up to carlots), St. Louis	7.52½	New York	8.25

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	22.00	20.00	16.25
Copper sheets, base	23.00	23.25	22.12½
Copper wire, base	20.62½	21.87½	20.75
Copper bars, base	22.25	23.75	22.62½
Copper tubing, base	25.25	25.87½	25.75
Brass sheets, base	19.62½	20.25	19.25
Brass tubing, base	24.25	26.00	25.00
Brass rods, base	17.62½	19.37½	18.37½
Brass wire, base	20.12½	21.25	20.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	27.20	28.00	27.00
Zinc sheets (casks)	12.00	11.75	11.37
Solder (½ and ½), (case lots)	42.00	37.50	.....
Babbitt metal (83% tin)	60.00	67.50	50.00
Babbitt metal (35% tin)	28.00	21.50	28.00
Nickel (ingots) f.o.b. refinery	29.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	33.00	.....	.....
Nickel (F shot) f.o.b. refinery	30.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50@12.75	12.50	12.00
Copper, heavy, and wire	12.25@12.50	12.25	11.50@11.75
Copper, light, and bottoms	10.75@11.00	10.25	10.50
Heavy lead	7.75@8.00	7.50	8.00
Tea lead	6.75@7.00	5.50	6.75
Brass, heavy, yellow	7.75@8.00	7.75	8.00@8.25
Brass, heavy, red	9.75@10.00	10.00	9.75
Brass, light	6.75@7.00	6.75	6.75
No. 1 yellow rod turnings	8.25@8.50	8.00	8.00
Zinc	4.50@4.75	4.00	5.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$21.00
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.80	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.50	13.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14@0.16
Cotton waste, colored, per lb.	.10@.15½	.18	.09½@.12¾
Wiping cloths, 13¼x13¼, per lb	9.50	36.00 per M	.11
Wiping cloths, 13¼x20¼, per lb.	....	50.00 per M	.11
Sal soda, per 100 lb. keg	2.25	2.25	2.25
Roll sulphur, per 100 lb. keg	3.60	3.25	3.75
Linseed oil, per gal., 5 bbl. lots	1.24	1.35	1.25
Lard cutting oil, 25% lard, per gal.	.60	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	40–2½%
Heavy grade	30–5%	30%	38–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–2%	60–5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0354
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.17621/2	.17621/2	.155
Solder (½ and ½)	per lb.	.42	.42½@43½	.3675
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.60	.60	.58
Machine oil	per gal.	.29	.29	.29
Belting, leather, medium	off list	40–2½%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	45%	45%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	.....
Emery paper	10.71	11.00	$11.90
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.65
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag	.....	.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.25@3.75
Coke, prompt foundry, Connellsville	per net ton		4.75@5.00
White lead, dry or in oil	100 lb. kegs		New York, 16.25
Red lead, dry	100 lb. kegs		New York, 16.25
Red lead, in oil	100 lb. kegs		New York, 17.75

SHOP SUPPLIES

	New York	Cleveland	Chicago
Rivets: Button heads, ¾-in., ⅞-in., 1x2-in. to 5-in., per 100 lb.	$3.75	$3.50	$3.50
Cone heads, ditto	3.85	3.60	3.70
Washers, cast iron: ½-in. per 100 lb.	6.50*	4.00	3.75
⅝-in., per 100 lb.	5.50*	4.00	3.75

Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland. Tap bolts with hex. heads are $4.65 per 100 lb. at Chicago.

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 45%; 1¼ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 35%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 40%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 35%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 45%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35%.

Bolt ends, 1x12-in., 10c. per lb., less 45%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 60%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Kan., Hutchins—Reno Planing Mill Co.—complete equipment and machinery, including planers, saws, etc.

La., Shreveport—Eco-Thermal Stove Co., Lebanon, O., S. O. Williams, V.-Pres.—machinery for assembling stoves, etc., for new plant at Agurs, near here.

Mass., Boston—J. E. Z., c/o Klein Co., 21 Beach St.—jig saw and lathe.

Mass., Boston—Perrine Quality Products Co., 48 Cummington St.—punch press for use with die about 10 x 18 in.

Mass., Boston—School House Dept., City Hall—manual training equipment including metal working machinery for the John Marshall District School, Dorchester.

Mass., Brighton (Boston P. O.)—Seavey Realty Trust Co., 7-15 Scottfield Rd.—miscellaneous tools and equipment for repair and service garage.

Mass., East Boston (Boston P. O.)—G. F. Carlin, 936-54 Bennington St.—equipment and miscellaneous tools for repair and service garage.

Mass., Lowell—G. L. Cady & Sons Co., Western Ave.—complete equipment for plant, for manufacture of machinist and mill supplies, to replace fire loss.

Mass., Milford—H. C. Ryan, 70 Main St.—automobile crane, at least 2½ tons.

Mass., Webster—Middlesex Casket Co.—complete equipment for new factory, to replace fire loss.

Mass., Worcester—Baldwin Chain & Mfg. Co., 199 Chandler St.—new equipment for factories at Auburn.

Mo., St. Louis—I. E. Kellough, 5645 Theodosia Ave.—small lathe for woodworking.

N. H. Laconia—W. T. Marsh, R.F.D. 1—sawmill machinery including planers, moulders, etc.

N. Y., Buffalo—C. C. Gibson, 70 Oak St.—equipment including small lathe, and tools for the manufacture of steel stamps, stencils, etc.

N. Y., Buffalo—R. S. McManus Steel Construction Co., 1238 East Ferry St.—equipment for steel fabricating plant.

N. Y., Buffalo—Masters Motor Corp., 17 West Utica St.—equipment, small tools, etc., for garage and repair shop.

N. Y., New York—American Metal Spinning & Stamping Co., 168 Center St.—horning presses No. 19 and 39 Bliss.

O., Dayton—National Steel Products Co.—1, Warner & Swasey No. 4 screw machine (used).

Okla., Miami—Lomax Industrial Corp., Lomax, Ill.—complete equipment for new factory, for the manufacture of brooms, here.

Pa., Latrobe — Vulcan Mould & Iron Works—20 ton overhead electric crane.

Pa., Oakmont—Edgewater Steel Co.—4 ft. radial drill, with taper attachment (used).

Pa., Pittsburgh — Pittsburgh Steel Co., Union Trust Bldg.—8 cranes, 7½ to 20 ton capacity, for Allenport plant.

Pa., Pittsburgh—United Engineering & Foundry Co., W. E. Sanborn, Pur. Agt., Framers Bank Bldg.—7½ overhead traveling crane.

Wis., Antigo—J. Wirig—complete equipment and tools for new machine and blacksmith shop.

Wis., Madison—Madison Motor Car Co., 324 West Gorham St.—complete equipment and tools for new machine shop.

Wis., Milwaukee—New Era Combustion Engine Co., 851 Kinnickinnic Ave.—milling machines, punches, automatics, drill presses.

Wis., Milwaukee—Roberts Brass Co., 178 Lincoln Ave.—Brass furnaces for new factory addition.

Wis., Portage—J. T. Henton Hwy. Comr., Columbia County, Portage—crane for 40 ft. span, lathe and drill press.

Wis., Wisconsin Rapids—F. Krieger Machine Co.—complete machinery and tools, for the manufacture of machine shop specialties, garage equipment, etc.

Ont., Cobourg—C. Copper—machinery for planing mill.

Ont., Fergus — Beatty Bros. — complete woodworking machinery, for the manufacture of washing machines, churns, pumps, stable equipment, etc.

Opportunities for Future Business

Calif., Los Angeles—Albertson Motor Car Co., 1540 South Figeroa St., is having plans prepared for the construction of a 2 story, 200 x 300 ft. factory, at 50th St. and Long Ave. Estimated cost $200,000. J. M. Cooper, Marsh Strong Bldg., Archt.

Ia., Mason City—Standard Oil Co., has had plans prepared for the construction of a plant, including machine shops at Caroline Ave., Southeast and 9th St. Estimated cost $120,000. Private plans.

Ia., Sioux City—Albertson Co., 3100 Floyd Ave. awarded contract for the construction of a 2 story, 150 x 165 ft. machine shop addition. Estimated cost $50,000. Noted Jan. 22.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

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BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

Kan., Hutchinson—Reno Planing Mill, plans the construction of an addition to planing mill here.

Ill., Rockford—Elco Tool & Screw Co. awarded contract for the construction of a 2 story, 60 x 190 tool and screw factory. Estimated cost $25,000. Noted Feb. 5.

Md., Baltimore—Masson's Express, 107 West Pratt St., G. F. Masson, Pres., will soon award contract for the construction of a 3 story, 90 x 140 ft. warehouse and garage, at Pratt & Poppleton Sts. Estimated cost $150,000. J. Freund, 1307 St. Paul St., Archt. Noted Feb. 19.

Mass., Boston — Kudish & Kager, 421 Seaver St., Roxbury, are having plans prepared for the construction of a 1 story, 125 x 300 ft. garage, on Massachusetts Ave. Estimated cost $200,000. A. Rosenstein, 220 Devonshire St., Boston, Archt.

Mass., Lowell—G. L. Cady & Sons Co., Western Ave., manufacturer of machinists and mill supplies, plans the construction of a factory to replace fire loss. Estimated cost $75,000. Engineer not selected.

Mass., Watertown—F. C. Hersee Co., 22 Parkman St., Brighton, manufacturers of automobile tools, plans the construction of a 1 story, 15,000 sq.ft., factory on Galen St. here. Estimated cost $60,000. Architect not selected.

Mass., Webster—Middlesex Casket Co. plans the construction of factory, to replace recent fire loss. Estimated cost $40,000. Engineer not selected.

Mo., North Kansas City—American Crossarm & Conduit Co., 332 South Michigan Ave., Chicago, Ill., awarded contract for the construction of a 1 story, 100 x 113 ft. factory.

Mo., Springfield—N. F. Fellow, and others, plan the construction of a 3 story automobile storage and commercial garage, on St. Louis St. Estimated cost $300,000.

N. Y., Troy—Town & Watkins, plan the construction of a 3 story 150 x 200 ft. garage on Fulton St. Estimated cost $250,000. Engineer and architect not selected.

N. C., Biltmore—Asheville Supply & Foundry Co., Asheville plans the construction of a machine shop for fabricating work, here. R. D. Hildebrand, Market and Eagle Sts., Asheville, Pres.

N. C., Charlotte—W. G. Jarrell Machine Co., 20 West Fourth St., W. G. Jarrell, Pres., awarded contract for the construction of a new machine shop at Mint and Palmer Sts. Estimated cost $29,000.

O., Cleveland—Brookins Co., 1741 Euclid Ave., C. F. Brookins, Pres., awarded contract for the construction of a 2 story, 35 x 140 ft. factory for the manufacture of light fixtures, at East 40th St. and Carnegie Ave. Estimated cost $50,000. Noted Nov. 13.

Okla., Miami—Lomax Industrial Corp., Lomax, Ill. plans the construction of a 1 story, 90 x 170 ft., factory, for the manufacture of brooms, here. Estimated cost $160,000. Architect not selected.

Va., Waverly—Gray-Lattimer, Co. plans the construction of a planing mill to replace fire loss. Estimated cost $35,000.

Wash., Seattle—Olive Way Building Co., Lyon Bldg., awarded contract for the construction of a 7 story, 78 x 120 ft. garage, at 6th and Olive Sts. Estimated cost $175,000.

Wis., Milwaukee—Builders' Needs Inc., 1243 Thirtieth St., E. C. Weissinger, Pres., has had plans prepared for the construction of a 2 story, 60 x 120 ft. building, for the manufacture of wood and metal building materials. Estimated cost $40,000. G. Zagel & Bros., 144 Oneida St., Archt.

Wis., Milwaukee—Harnischfeger Corp. 38th and National Aves, A. G. Hendricks, V.-Pres., manufacturers of electric traveling cranes, machine tools, etc., plans the construction of an addition to electric foundry, at 871-91 Robinson Ave. Estimated cost $15,000.

Wis., Milwaukee—John Topzant, 144 Oneida St., Archt, will receive bids until March 5, for the construction of a 2 story, 80 x 112 ft. factory addition on Lincoln Ave., for the Roberts Brass Co. 178 Lincoln Ave. Estimated cost $60,000.

Wis., West Allis—Le Roi Co., 60th Ave. and Mitchell St., manufacturers of gasoline engines, awarded contract for the construction of a 1 story, 122 x 164 ft. addition to factory. Estimated cost $50,000.

Ont., Fergus—Beatty Bros. plans the construction of a factory addition for the manufacture of washing machines, churns, pumps, staple equipment, etc. Estimated cost $100,000.

Que., Thurso—Singer Mfg. Co., Ottawa, Ont., plans the construction of a new plant here. Estimated cost $250,000. M. H. Elmitt, Bank National Bldg., Ottawa, Ont., Mgr. Noted Jan. 22.